

Helminth fauna of the Eurasian Marsh Frog, *Pelophylax ridibundus* (Pallas, 1771) (Anura: Ranidae), collected from Denizli Province, Inner-West Anatolia Region, Turkey

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Summary

In this research, a total of 298 Eurasian marsh frogs, *Pelophylax ridibundus* (Pallas, 1771) were collected from different localities in Denizli province (Inner-west Anatolia Region, the eastern part of Aegean Region) Turkey between 2006 and 2009 and examined for helminths. Of 262 (87.91 %) *Pelophylax ridibundus* samples were infected with one or more helminths. *Pelophylax ridibundus* harbored eight species of digeneans (*Diplodiscus subclavatus*, *Gorgoderina vitelliloba*, *Gorgoderina cygnoides*, *Pleurogenoides medians*, *Prosotocus confusus*, *Skrjabinoeces breviansa*, *Encyclometra colubrimurorum* and *Ophistoglyche ranae*), one species of cestode (*Nematotaenia dispar*), two species of acanthocephalans (*Acanthocephalus ranae* and *Pomphorhynchus laevis*), and six species of nematodes (*Rhabdias bufonis*, *Oswaldocruzia filiformis*, *Cosmocerca ornata*, *Oxysomatium brevicaudatum*, *Eustrongylides* sp. and *Abbreviata* sp.). *P. ridibundus* represents a host record for *Nematotaenia dispar* in Turkey.

Keywords: Amphibians, Denizli, Helminth, *Pelophylax ridibundus*, Turkey

Introduction

The Eurasian marsh frog, *Pelophylax ridibundus* (formerly known as *Rana ridibunda*), is a medium-sized semi-aquatic anuran species. *P. ridibundus* inhabits lakes, pools, or slowly flowing streams. It is a highly opportunistic diurnal amphibian, living in mixed and deciduous forests, forest steppe, and steppe and other grasslands, semi-desert and desert zones. Arid areas are largely colonized through river valleys and channels. *P. ridibundus* prefers open, well-warmed areas with abundant herbaceous vegetation (IUCN, 2012). In Turkey, this species is known in all suitable habitats except for a portion of the Lakes District (Baran & Atatür, 1997; Budak & Göçmen, 2008).

To our knowledge, the first helminthological study in Eurasian marsh frog, *P. ridibundus* (formerly known as *Rana ridibunda*) was reported by Schäd *et al.* (1960) and they recorded only two nematodes in this species from Turkey. Other helminthological studies on *P. ridibundus* published by Saygı and Başibüyük (1990), Oğuz *et al.* (1994), Yıldırımhan *et al.* (1996, 1997, 2005a), Kır *et al.* (2001), Düşen and Öz (2006), Sağlam and Arıkan (2006), Unal *et al.* (2007), Düşen and Oğuz (2008, 2010), Düşen *et al.* (2010a), Heckmann *et al.* (2010, 2011) in Turkey.

So far, there has been no published detailed study on helminths of Eurasian marsh frog, *P. ridibundus* from Denizli province (Inner-west Anatolia Region - the eastern part of Aegean Region) in Turkey. This is the first detailed helminthological study, which has been done in this geographic area.

Materials and methods

Frog samples were collected by hand and dip net, between 2006 – 2009 from 17 different localities in Denizli province (38°29' – 38°52' N – 28°38' – 30°05' E). In total, 298 *P. ridibundus* (197♂♂, 101♀♀) were examined for helminth parasites. The mean ± SD snout-vent length (SVL) of specimens was 66.34 ± 14.91 mm, with a range from 29 to 101 mm; within 24 hr, toads were overdosed in ether-filled glass containers.

The samples body cavity was opened by a longitudinal ventral incision. The alimentary canal was excised and separated into stomach, small intestine, large intestine and rectum. The contents of each part and other organs (lungs, liver, gall bladder, kidneys and urinary bladder) were each mixed with 0.5 % saline solution and poured into petri dishes for examination under a stereomicroscope. The muscles, plus portions of peritoneum and spinal cord, were teased out with needles and examined under a stereomicro-

scope. Digeneans was immobilized by coverslip pressure in 70 % ethyl alcohol, fixed, and stored in 70 % ethanol. Nematodes was straightened by heat, fixed, and stored in 70 % ethyl alcohol with 5 % glycerol. Acanthocephalans were relaxed in saline and heat-fixed under slight coverslip pressure in warm ethyl alcohol-formalin-acetic acid. Digeneans, acanthocephalans and cestode samples were stained with acetocarmine, dehydrated, cleared in cedar oil or xylol, and mounted in Canada Balsam; nematodes were cleared in glycerol and examined. Intensities are presented as mean values (± 1 SE) followed by the range. Voucher host specimens and parasite specimens were deposited in Pamukkale University, Faculty of Sciences and Arts, Department of Biology, Denizli, Turkey (PAU-HELM-1-17/2009).

Results and discussion

Two-hundred and ninety eight *P. ridibundus* (197♂♂, 101♀♀) samples were collected between 2006 – 2009 years from Denizli province.

Trematoda

Family: Diplodiscidae

Diplodiscus subclavatus (Pallas, 1760) Diesing, 1836

Prevalence, intensity and range: Hosts infected, 31 of 298 (10.40 %, 4.03 ± 0.65 SE, 1 – 15).

Other reported hosts: *D. subclavatus* was observed in, *Triturus cristatus*, *T. vulgaris*, *Bufo viridis*, *Hyla arborea* (Shimalov *et al.*, 2001; Vojtková & Vojtek 1975, Buchvarov 1977, Kuc & Sulgostowska 1988b, Sey 1991); *H. savignyi* (Yıldırımhan *et al.*, 2012); *Rana temporaria*, *R. dalmatina*, *R. esculenta*, *R. graeca* (Vojtková & Vojtek 1975; Buchvarov, 1977; Kuc & Sulgostowska, 1988b; Sey, 1991; Düşen *et al.*, 2009), *Bombina bombina*, *Bo. variegata* (Vojtková & Vojtek, 1975; Grabda-Kazubska & Lewin, 1989), *Pelobates syriacus balcanicus* (Buchvarov, 1977), *T. alpestris*, *P. fuscus*, *R. lessonae* (Vojtková & Vojtek, 1975), *B. bufo*, *R. arvalis* (Vojtková & Vojtek, 1975; Sey 1991; Shimalov & Shimalov, 2001), *R. holtzi* (Topçu, 2002; Yıldırımhan *et al.*, 2006b), *Natrix natrix* (Sey, 1991; Buchvarov *et al.*, 2000; Shimalov & Shimalov, 2000), *N. tessellata* (Buchvarov *et al.*, 2000), *Vipera berus* (Shimalov & Shimalov, 2000) and *Esox lucius* (Öztürk *et al.*, 2000).

Geographic range: Europe (Yamaguti, 1958), Czech Republic (Vojtková & Vojtek, 1975), Bulgaria (Buchvarov *et al.*, 1975; Buchvarov, 1977), Poland (Kuc & Sulgostowska, 1988a, 1988b; Grabda-Kazubska & Lewin, 1989), Hungaria (Sey, 1991), Turkey (Oğuz *et al.*, 1994), Iran (Masshaii *et al.*, 2000), Uzbekistan (Vashetko & Siddikov, 1999).

Specimens deposited: PAU-HELM-1/2009

Family: Gorgoderidae

Gorgoderina vitelliloba (Olsson, 1876) Loos, 1902

Prevalence, intensity and range: Hosts infected, 20 of 298 (6.71 %, 2.55 ± 0.81 SE, 1 – 13).

Other reported hosts: *G. vitelliloba* was reported in, *Bombinator igneus* (Yamaguti, 1958), *Bo. bombina* (Vojtková

& Vojtek, 1975), *Bo. variegata*, (Yamaguti, 1958; Vojtková & Vojtek, 1975; Buchvarov, 1977) *B. bufo* and *B. calamita* (Cedhagen, 1988), *B. viridis* (Buchvarov, 1977), *R. arvalis* (Yamaguti, 1958; Vojtková & Vojtek, 1975), *R. dalmatina* (Buchvarov, 1977), *R. esculenta*, (Vojtková & Vojtek, 1975), *R. temporaria* (Yamaguti, 1958; Vojtková & Vojtek, 1975; Buchvarov, 1977; Cedhagen, 1988), *R. macronemis* (Yıldırımhan *et al.*, 1997b; Yıldırımhan *et al.*, 2006a), *R. camerani* (Yıldırımhan *et al.*, 2006a) and *R. holtzi* (Yıldırımhan *et al.*, 2006b).

Geographic range: Europe and North America (Yamaguti, 1958), Czech Republic (Vojtková & Vojtek, 1975), Bulgaria (Buchvarov, 1977), Poland (Kuc & Sulgostowska, 1988a, 1988b), Turkey (Yıldırımhan *et al.*, 1996; Düşen & Öz, 2006).

Specimens deposited: PAU-HELM-2/2009

Family: Gorgoderidae

Gorgodera cygnoides (Zeder, 1800)

Prevalence, intensity and range: Hosts infected, 36 of 298 (12.08 %, 3.83 ± 0.70 SE, 1 – 17).

Other reported hosts: *G. cygnoides* is a common parasite of amphibians, *Bombinator igneus* (Yamaguti, 1958), *Bo. Bombina* and *Bo. variegata* (Vojtková & Vojtek, 1975), *B. viridis* (Buchvarov, 1977; Shimalov & Shimalov, 2001), *H. arborea* (Yamaguti, 1958), *R. arvalis* (Vojtková & Vojtek, 1975), *R. dalmatina* (Buchvarov, 1983), *R. esculenta* (Yamaguti, 1958; Vojtková & Vojtek, 1975; Buchvarov, 1977; Kuc & Sulgostowska, 1988b), *R. lessonae* (Vojtková & Vojtek, 1975), *R. clamitans* (Yamaguti, 1958), *R. temporaria* (Yamaguti, 1958; Vojtková & Vojtek, 1975), *R. camerani* (Yıldırımhan *et al.*, 2006a), *R. holtzi* (Yıldırımhan *et al.*, 2006b), *R. kurtmuelleri* (Hristovski *et al.*, 2006) and *Pelodytes caucasicus* (Yıldırımhan *et al.*, 2009).

Geographic range: Western Europe (Yamaguti, 1958) Turkey (Yıldırımhan *et al.*, 1996; Düşen & Öz, 2006).

Specimens deposited: PAU-HELM-3/2009

Family: Lecithodendriidae

Pleurogenoides medians (Olsson, 1876) Travassos, 1921

Prevalence, intensity and range: Hosts infected, 47 of 298 (15.77 %, 27.70 ± 4.57 SE, 1 – 126).

Other reported hosts: *P. medians* has been reported in various amphibians and reptiles species, *T. cristatus* (Shimalov *et al.*, 2001), *T. vulgaris* (Vojtková & Vojtek, 1975; Shimalov *et al.*, 2001); *Bo. bombina*, (Vojtková & Vojtek, 1975), *Bo. variegata*, (Vojtková & Vojtek, 1975), *B. bufo* (Shimalov & Shimalov, 2001), *B. calamita*, (Vojtková & Vojtek, 1975), *B. vulgaris* (Yamaguti, 1958), *B. viridis* (Düşen *et al.*, 2010; Düşen & Oğuz, 2010), *H. arborea* (Vojtková & Vojtek, 1975; Düşen & Öz, 2004), *H. savignyi* (Yıldırımhan *et al.*, 2012), *R. arvalis* (Vojtková & Vojtek, 1975), *R. camerani* (Yıldırımhan *et al.*, 2006a; Düşen, 2007), *R. dalmatina* (Buchvarov, 1977; Düşen *et al.*, 2009), *R. esculenta* (Vojtková & Vojtek, 1975; Buchvarov, 1977; Kuc & Sulgostowska, 1988b), *R. macronemis* (Yıldırımhan *et al.*, 2006b; Düşen, 2007), *R. arvalis* (Vojtková & Vojtek, 1975), *R. temporaria* (Vojtková &

Vojtek, 1975; Cedhagen, 1977), *R. holtzi* (Topçu, 2002), *Lacerta trilineata* (Yamaguti, 1963; Yıldırımhan *et al.*, 2011), *N. natrix* (Kirin, 2000b) and *Atheris hispida* (Hassl, 2010; Hassl *et al.*, 2010).

Geographic range: Europe and Asia (Yamaguti, 1958); Australasian Regions (Prudhoe & Bray, 1982).

Specimens deposited: PAU-HELM-4/2009

Family: Lecithodendriidae

Prosotocus confusus (Loos, 1894) Loos, 1899

Prevalence, intensity and range: Hosts infected, 23 of 298 (7.72 %, 5.82 ± 1.33 SE, 1 – 33).

Other reported hosts: *R. esculenta* (Yamaguti, 1958; Vojtková & Vojtek, 1975; Buchvarov, 1977; Kuc & Sulgostowska, 1988b), *B. viridis* (Yamaguti, 1958; Vojtková & Vojtek, 1975), *B. vulgaris* (Yamaguti, 1958), and *Bo. variegata*, *B. bufo*, *B. calamita*, *H. arborea*, *R. temporaria*, *R. arvalis* (Vojtková & Vojtek, 1975; Buchvarov, 1977), This species is only observed in *R. ridibunda* (Yıldırımhan *et al.*, 1996, 2005a; Düşen & Öz 2006) from Turkey. **Geographic range:** Europe and Asia (Yamaguti, 1958), Turkey (Yıldırımhan *et al.*, 1996, 2005a; Düşen & Öz 2006).

Specimens deposited: PAU-HELM-5/2009

Family: Plagiorchiidae

Skrjabinoeces breviansa (Sudarikov, 1950)

Prevalence, intensity and range: Hosts infected, 29 of 298 (9.73 %, 5.34 ± 1.10 SE, 1 – 35).

Other reported hosts: Sey and Eory (1992) were reported *Skrjabinoeces breviansa* in *R. ridibunda* from Hungary, Mashai *et al.* (2000) were reported *S. breviansa* in *R. ridibunda* from Northern parts of Iran. Kovalenko (2007) was recorded this digenean in *R. ridibunda* and *R. esculenta* from Ukraine. Yıldırımhan *et al.* (2005a), Düşen and Öz (2006), Düşen and Oğuz (2010) were recorded this helminth species in *R. ridibunda* from Turkey.

Geographic range: Europe, Russia (Yamaguti, 1958), Turkey (Yıldırımhan *et al.*, 2005a; Düşen and Öz (2006), and Iran (Mashai *et al.*, 2000).

Specimens deposited: PAU-HELM-6/2009

Family: Plagiorchiidae

Encyclometra colubrimurorum (Rudolphi, 1819) Dollfus, 1922 (Metacercariae)

Prevalence, intensity and range: Hosts infected, 7 of 298 (2.35 %, 2.43 ± 1.11 SE, 1 – 8).

Other reported hosts: *R. tigrina*, *Xenochnopsis piscator*, *Coluber gemonensis*, *Ptyas mucosus*, (Yamaguti, 1958); *N. natrix* (Yamaguti, 1958; Shimalov & Shimalov, 2000; Mihalca *et al.*, 2007); *Bo. bombina*, *P. fuscus*, *B. viridis*, *R. dalmatina*, *R. temporaria* (Vojtková & Vojtek, 1975); *R. esculenta* (Buchvarov, 1977); *H. arborea* (Vojtková & Vojtek, 1975; Düşen & Öz, 2004). The definitive host of *E. colubrimurorum* is a colubrid snake, *N. natrix* (grass snake) (Liang-Sheng, 1958), *E. colubrimurorum* parasitised *P. ridibundus* as an intermediate host. Düşen and Öz (2006) observed this digenean from *R. ridibunda* in An-

talya region in Turkey.

Geographic range: Europe, Asia (Yamaguti, 1958); Czech Republic, France, Italy, Russia, The Netherlands (Vojtková & Vojtek, 1975); Iran (Masshai *et al.*, 2000); Turkey (Düşen & Öz, 2004; Düşen & Öz, 2006).

Specimens deposited: PAU-HELM-7/2009

Family: Telorchidae

Opisthioglyphe ranae (Froelich, 1791)

Prevalence, intensity and range: Hosts infected, 4 of 298 (1.34 %, 4.75 ± 0.85 SE, 3 – 7).

Other reported hosts: The reported hosts of *O. ranae* were, *Salamandra maculosa* (Vojtková & Vojtek, 1975; Buchvarov, 1977); *T. cristatus* (Yamaguti, 1958; Shimalov *et al.*, 2001), *T. vulgaris* (Shimalov *et al.*, 2001), *Bo. bombina* (Vojtková & Vojtek, 1975; Yıldırımhan *et al.*, 2001a), *Bo. variegata* (Vojtková & Vojtek, 1975), *B. bufo* (Shimalov & Shimalov, 2001), *B. calamita* (Yamaguti, 1958; Shimalov & Shimalov, 2001), *B. vulgaris*, *B. variabilis*, (Yamaguti, 1958), *B. viridis*, (Vojtková & Vojtek, 1975; Buchvarov, 1977), *H. arborea* (Vojtková & Vojtek, 1975; Buchvarov, 1977), *P. fuscus* (Vojtková & Vojtek, 1975); *R. dalmatina* (Vojtková & Vojtek, 1975; Buchvarov, 1977), *R. esculenta* (Yamaguti, 1958; Vojtková & Vojtek, 1975; Buchvarov, 1977), *R. lessonae* (Vojtková & Vojtek, 1975), *R. temporaria* (Yamaguti, 1958; Vojtková & Vojtek, 1975; Buchvarov, 1977), *R. arvalis* (Vojtková & Vojtek, 1975), *R. camerani* (Yıldırımhan *et al.*, 2006a), *R. holtzi* (Topçu, 2002), *N. Natrix* and *V. berus* (Shimalov & Shimalov, 2000).

Geographic range: Europe (Yamaguti, 1958), Turkey (Yıldırımhan *et al.*, 1996; Düşen & Öz, 2006), Saudi Arabia (Fernando, 1989), Iran (Masshai *et al.*, 2000).

Specimens deposited: PAU-HELM-8/2009

Cestoda

Family: Nematotaeniidae

Nematotaenia dispar (Goeze, 1782) Lühe, 1899

Prevalence, intensity and range: 2 of 298 hosts infected (0.67 %, 2, 2).

Other reported hosts: *N. dispar* is commonly parasitic in the intestines of amphibians, but rarely reptiles of the Oriental, Nearctic, and Palearctic regions (Prudhoe & Bray, 1982), including *Bo. bombina* (Buchvarov, 1977), *Bo. variegata* (Buchvarov, 1977; Prudhoe & Bray, 1982), *B. bufo* (Hristovski & Riggio, 1971; Prudhoe & Bray, 1982), *B. alvarius* (Goldberg & Bursey, 1991), *H. arborea* (Hristovski & Riggio, 1974; Buchvarov, 1977; Prudhoe & Bray, 1982; Vashetko & Siddikkov, 1999; Saeed *et al.*, 2007), *H. savignyi* (Al-Sorkhy & Amr, 2003; Mashai, 2005; Yıldırımhan *et al.* 2012), *R. temporaria* (Hristovski & Lees, 1973; Buchvarov, 1997), *R. dalmatina* (Buchvarov, 1977), *Mertensiella caucasica* (Yıldırımhan *et al.*, 2001b; 2005b), *Amietophrynus (Bufo) regularis* (Ibrahim, 2008), *B. viridis* (Hristovski & Riggio, 1971; Buchvarov, 1977; Yıldırımhan, 1999; Düşen, 2003, 2011; Saeed *et al.*, 2007; Masshai *et al.*, 2008; Düşen *et al.*, 2010a; Düşen & Oğuz,

2010), *R. camerani* (Yıldırımhan *et al.*, 2006a). Buchvarov (1977) recorded this cestode in *R. ridibunda* from, Bulgaria.

Geographic range: Palaearctic, Oriental and Australian regions (Prudhoe & Bray, 1982; Al-Sorkhy & Amr, 2003). *Nematotaenia dispar* is first time observed in *P. ridibundus* from Turkey.

Specimens deposited: PAU-HELM-9/2009

Nematoda

Family: Rhabdiasidae

Rhabdias bufonis (Schränk, 1788) Stiles and Hassal, 1905
Prevalence, intensity and range: 19 of 298 hosts infected (6.37 %, 2.05 ± 0.23 SE, 1 – 10).

Other reported hosts: *R. bufonis* is known from various amphibian species including, *Bufo* sp., *Rana* sp., *Pelobates* sp., *Bombinator* sp., *Anguis fragilis* (Yamaguti, 1961; Düşen *et al.*, 2010b), *Bo. bombina* (Grabda-Kazubska & Lewin, 1989; Yıldırımhan *et al.*, 2001a), *Pe. caucasicus* (Yıldırımhan *et al.*, 2009), *R. esculenta* (Buchvarov, 1977; Kuc & Sulgostowska, 1988b), *Bo. variegata*, *P. syriacus* (Buchvarov, 1977), *B. viridis* (Buchvarov *et al.*, 1975; Buchvarov, 1977; Yıldırımhan, 1999a; Shimalov & Shimalov, 2001; Düşen, 2011), *B. bufo* (Buchvarov, 1977; Shimalov & Shimalov, 2001; Yıldırımhan & Karadeniz, 2007; Düşen, 2011), *B. calamita* (Shimalov & Shimalov, 2001), *Amietophrynus (Bufo) regularis* (Ibrahim, 2008), *R. temporaria*, *R. arvalis* (Kuc & Sulgostowska, 1988b; Cedhagen, 1988), *R. dalmatina* (Buchvarov *et al.*, 1975; Buchvarov, 1977; Düşen *et al.*, 2009), *R. camerani* (Yıldırımhan *et al.*, 2006a), *R. macrocnemis* (Yıldırımhan *et al.*, 2006b).

Geographic range: Europe, Siberia, China, Canada, U.S.A. (Yamaguti, 1961).

Specimens deposited: PAU HEL-10/2009

Family: Molineidae

Oswaldocruzia filiformis (Goeze, 1782) Travassos, 1917
Prevalence, intensity and range: 17 of 298 hosts infected (5.70 %, 2.47 ± 0.70 SE, 1 – 10).

Other reported hosts: *O. filiformis* is recorded from various amphibian and reptile species, including *Salamandra salamandra* (Buchvarov, 1977), *T. alpestris* and *T. karelinii* (Buchvarov, 1977; Cedhagen 1988; Kirin & Buchvarov, 2002), *T. vulgaris* (Buchvarov, 1977; Shimalov *et al.*, 2001), *T. vittatus* (Yıldırımhan, 2008), *Bo. bombina* and *Bo. variegata* (Buchvarov, 1977; Kirin & Buchvarov, 2002), *B. regularis* (probably *Bufo viridis*) (Schad *et al.*, 1960), *B. viridis* (Buchvarov, 1977; Yıldırımhan, 1999; Shimalov & Shimalov, 2001; Topçu & Bayrak, 2000; Düşen *et al.*, 2010a; Düşen & Oğuz, 2010), *B. bufo* (Buchvarov, 1977; Yıldırımhan & Karadeniz, 2007; Düşen & Oğuz, 2010; Düşen, 2011); *Pe. caucasicus* (Yıldırımhan *et al.*, 2009), *H. arborea* (Buchvarov, 1977; Yıldırımhan *et al.*, 2006c), *R. camerani* (Yıldırımhan *et al.*, 2006a); *H. savignyi* (Yıldırımhan *et al.*, 2012); *R. dalmatina*, (Buchvarov *et al.*, 1975; Buchvarov, 1977; Kirin & Buchvarov, 2002; Düşen *et al.*, 2009), *R. kurtmuelleri* (Hristovski *et*

al., 2006), *R. macrocnemis* (Schad *et al.*, 1960; Yıldırımhan *et al.*, 1997b; Yıldırımhan *et al.*, 2006b), *R. temporaria*, (Buchvarov, 1977; Cedhagen, 1988; Kirin & Buchvarov, 2002), *R. graeca* (Božkov & Stojkova, 1970; Buchvarov, 1977), *L. agilis*, (Sharpilo *et al.*, 2001; Shimalov *et al.*, 2000; Mihalca *et al.*, 2007), *L. trilineata* (Yıldırımhan *et al.*, 2011), *L. viridis* (Biserkov & Kostadinova, 1998; Yıldırımhan, 1999b; Kirin, 2002a; Borkovcová & Kopřiva, 2005), *L. vivipara* (Shimalov *et al.*, 2000), *A. fragilis* (Schad *et al.*, 1960; Bertman & Okulewicz, 1987; Shimalov *et al.*, 2000; Borkovcová & Kopřiva 2005; Düşen *et al.*, 2010b), *Zootoca vivipara* (Sanchis *et al.*, 2000), *N. natrix* (Bertman & Okulewicz, 1987; Shimalov & Shimalov, 2000; Kirin 2002b) and *V. berus* (Shimalov & Shimalov, 2000).

Geographic range: Europe and Asia (Yamaguti, 1961).

Specimens deposited: PAU-HELM-11/2009

Family: Cosmocercidae

Cosmocerca ornata (Dujardin, 1845)

Prevalence, intensity and range: 114 of 298 hosts were infected (38.25 %, 5.28 ± 0.75 SE, 1 – 47).

Other reported hosts: There are several papers reporting *C. ornata* from many species of amphibians and reptiles, including *Bufo*, *Hyla*, *Rana*, *Triturus* (Yamaguti, 1961), *T. alpestris* (Walton, 1933; Buchvarov, 1977; Shimalov *et al.*, 2000), *T. cristatus* (Walton, 1933; Shimalov *et al.*, 2001), *T. vulgaris* (Shimalov *et al.*, 2001), *Bo. bombina*, (Buchvarov, 1977; Grabda-Kazubska & Lewin, 1989); *Bo. variegata* (Buchvarov, 1977; Grabda-Kazubska & Lewin, 1989; Kirin & Buchvarov, 2002), *B. viridis* (Schad *et al.*, 1960; Buchvarov *et al.*, 1975; Buchvarov, 1977; Vashetko & Siddikov, 1999; Masshah, 2005; Düşen & Oğuz, 2010; Düşen *et al.*, 2010; Düşen 2011), *B. bufo* (Buchvarov, 1977; Shimalov & Shimalov, 2001; Yıldırımhan & Karadeniz, 2007; Düşen & Oğuz, 2010; Düşen *et al.*, 2010; Düşen 2011); *Pe. caucasicus* (Yıldırımhan *et al.*, 2009), *H. arborea* (Buchvarov, 1977; Yıldırımhan *et al.*, 2006c), *P. syriacus* (Buchvarov, 1977; Shimalov *et al.*, 2000), *R. esculenta* (Walton, 1933; Buchvarov, 1977), *R. arvalis* (Cedhagen, 1988; Kuc & Sulgostowska, 1988b), *R. temporaria*, (Walton, 1933; Buchvarov, 1977; Kuc & Sulgostowska, 1988b), *R. graeca* (Božkov & Stojkova, 1970; Buchvarov, 1977), *R. holtzi* (Yıldırımhan *et al.*, 2006b), *R. macrocnemis* (Schad *et al.*, 1960; Yıldırımhan *et al.*, 2006b; Düşen, 2007), *R. camerani* (Yıldırımhan *et al.*, 2006a; Düşen, 2007), *R. dalmatina* (Buchvarov, 1977; Düşen *et al.*, 2009), *R. tavasensis* (Düşen, 2012); *Chiasmocleis capixaba* (Van Sluys *et al.*, 2006) and *A. fragilis* (Shimalov *et al.*, 2000; Düşen *et al.*, 2010b).

Geographic range: New and Old Worlds (Baker, 1987).

Specimens deposited: PAU-HELM-12/2009

Oxysomatium brevicaudatum (Zeder, 1800) Railliet and Henry, 1916

Prevalence, intensity and range: 22 of 298 hosts were infected (7.38 %, 8.86 ± 2.19 SE, 1 – 32).

Other reported hosts: *O. brevicaudatum* was reported from

different hosts of amphibians and reptiles in Europe and Asia, including *Bombina*, *Bufo*, *Hyla*, *Pelobates*, *Rana*, *Salamandra* (Yamaguti, 1961), *S. salamandra*, *S. atra*, *Pseudotriton ruber* and *Bo. bombina* (Walton, 1933), *T. vittatus*, *T. karelinii* (Yıldırımhan, 2008), *P. syriacus* (Yıldırımhan *et al.*, 1997a; Yıldırımhan & Bursey, 2010), *B. viridis* (Walton, 1933; Schad *et al.*, 1960; Buchvarov, 1977; Yıldırımhan, 1999a; Topçu & Bayrak, 2000; Düşen

& Oğuz, 2010; Düşen *et al.*, 2010; Düşen, 2011), *B. bufo* (Düşen & Oğuz, 2010; Düşen *et al.*, 2010; Düşen, 2011), *B. regularis* (probably *B. viridis*) (Schad *et al.*, 1960), *H. arborea* (Walton, 1933), *R. dalmatina* (Buchvarov, 1977; Düşen *et al.*, 2009), *R. graeca* (Božkov & Stojkova, 1970; Buchvarov, 1977), *R. esculenta* (Walton, 1933), *R. kurtmuelleri* (Hristovski *et al.*, 2006), *R. macrocnemis* (Schad *et al.*, 1960), *R. temporaria* (Walton, 1933; Buch-

Table 1. Prevalence, intensity, infection sites and range of helminths in *P. ridibundus*

Identified helminth group	Developmental stage	Site of infection	No. of infected (%)	Mean intensity (\pm SE)	Range
<i>Diplodiscus subclavatus</i> (Pallas, 1760) Diesing, 1836	Adult	LI	31 (10.40)	4.03 \pm 0.65	1 – 15
<i>Gorgoderina vitelliloba</i> (Olsson, 1876) Loos, 1902	Adult	UB	20 (6.71)	2.55 \pm 0.81	1 – 13
<i>Gorgoderia cygnoides</i> (Zeder, 1800)	Adult	UB	36(12.08)	3.83 \pm 0.70	1 – 17
<i>Pleurogenoides medians</i> (Olsson, 1876) Travassos, 1921	Adult	SI	47 (15.77)	27.70 \pm 4.57	1 – 126
<i>Prosotocus confusus</i> (Loos, 1894) Loos, 1899	Adult	SI	23 (7.72)	5.82 \pm 1.33	1 – 33
<i>Skryabinoces breviansa</i> (Sudarikov, 1950)	Adult	L	29 (9.73)	5.34 \pm 1.10	1 – 35
<i>Encyclometra colubrimurorum</i> (Rudolphi,1819) Dollfus, 1922	Metacercariae	M, OS, BC	7 (2.35)	2.43 \pm 1.11	1 – 8
<i>Opisthioglyphe ranae</i> (Froelich, 1791)	Adult	SI	4 (1.34)	4.75 \pm 0.85	3 – 7
<i>Nematotaenia dispar</i> (Goeze, 1782) Lühe, 1899	Adult	SI	2 (0.67)	2	2
<i>Rhabdias bufonis</i> (Schrank, 1788) Stiles and Hassal, 1905	Adult	L	19 (6.37)	2.05 \pm 0.23	1 – 10
<i>Oswaldocruzia filiformis</i> (Goeze,1782) Travassos, 1917	Adult	SI	17 (5.70)	2.47 \pm 0.70	1 – 10
<i>Cosmocerca ornata</i> (Dujardin, 1845)	Adult	LI, SI	114 (38.25)	5.28 \pm 0.75	1 – 47
<i>Oxysomatium brevicaudatum</i> (Zeder, 1800) Railliet and Henry, 1916	Adult	LI, SI	22 (7.38)	8.86 \pm 2.19	1 – 32
<i>Eustrongylides sp.</i>	Larvae	LI, SI	3 (1.01)	1	1
<i>Abbreviata sp.</i> (Encapsulated larvae in submucosa of stomach and small intestine)	Larvae	S, LI, OS	35 (11.74)	1	Uncount.
<i>Acanthocephalus ranae</i> (Schrank, 1788) Lühe, 1911	Adult	SI, LI	63 (21.14)	4.92 \pm 0.67	1 – 26
<i>Pomphorhynchus laevis</i> (Zoega in Müller 1776)	Larvae and cysts	M, B, LI, SI	55 (18.45)	21.36 \pm 1.33	1 – 79

BC: Body cavities, L: Lung, LI: Large intestine, M: Mesentery, OS: Organ surfaces, R: Rectum, S: Stomach, SI: Small intestine; UB: Urinary bladder

varov, 1977; Kirin & Buchvarov, 2002), *P. fuscus* (Walton, 1933), *R. kurtmuelleri* (Hristovski *et al.*, 2006), *A. fragilis* (Schad *et al.*, 1960; Sharpilo, 2003; Düşen *et al.*, 2010b), *N. natrix* (Schad *et al.*, 1960).

Geographic range: Europe and Asia (Yamaguti, 1961). Schad *et al.* (1960) were first time reported *O. brevicaudatum* in *Bufo regularis* (probably *B. viridis*), *B. viridis*, *R. macrocnemis*, *R. ridibunda* and *A. fragilis* from Turkey. Sharpilo (2003) pointed out that *O. brevicaudatum* has a great disperse in *A. fragilis* in the Caucasian Region.
Specimens deposited: PAU-HELM-13/2009

Family: Dioctophymatidae

***Eustrongylides* sp. (larvae)**

Prevalence, intensity and range: Hosts infected, 3 of 298 (1.01 %, 1, 1).

Other reported hosts: *Eustrongylides* sp. is parasitic in glands of proventriculus of aquatic birds. Larvae normally inhabited connective tissue and body cavities of fishes (Yamaguti, 1961). Yıldırımhan *et al.* (1996b) and Aydođdu *et al.* (1996a, 1996b, 1997 and 2000) recorded this nematode larvae in *N. natrix*, roach (*Rutilus frisii*), sheatfish (*Silurus glanis*), and tench (*Tinca tinca*) from Lake Iznik (Bursa). Mihalca *et al.* (2007) were recorded this nematode in *N. natrix* and *N. tessellata* in Romania. Anderson (2000) stated that the larvae of this nematode is observed in *R. ridibunda*. Düşen and Öz (2006) reported this nematode larvae in *R. ridibunda* from Antalya Region in Turkey.

Geographic range: Europe south-east Asia, the Middle East and Australia (Anderson, 2000).

Specimens deposited: PAU-HELM-14/2009

Family: Physalopteridae

***Abbreviata* sp. (larvae - Encapsulated larvae in submucosa of stomach and small intestine).**

Prevalence, intensity and range: Hosts infected, 35 of 298 (11.74 %, Uncountable).

Other reported hosts: Fernando (1989) observed this nematode larvae in *R. ridibunda* from Saudi Arabia; Fernando (1989) reported that parasite larvae in brown cysts where located subcutaneously on body wall, heavy infestations also occurred in the submucosae of stomach, small intestine and mesenteries and embedded deeply in them muscle. Similarly, Düşen and Öz (2006) observed this encapsulated larvae in submucosa of stomach and small intestines of *R. ridibunda* from Antalya region in Turkey. Borkovcová and Kopriva (2005) recorded this nematode species in some lizards (*A. fragilis*, *L. viridis* and *L. agilis*) and one snake (*Coronella austriaca*) species in South Moravia (Czech Republic). In this study, the larvae of *Abbreviata* sp. were observed numerous (embedded deeply in submucosa of the stomach and small intestine) therefore counting was difficult.

Geographic range: Europe Asia, and Western Australia (Anderson, 2000).

Specimens deposited: PAU-HELM-15/2009

Acanthocephala

Family: Echinorhynchidae

***Acanthocephalus ranae* (Schrank, 1788) Lühe, 1911**

Prevalence, intensity and range: 63 of 298 hosts were infected (21.14 %, 4.92 ± 0.67 SE, 1 – 26).

Other reported hosts: *Rana* sp., *Bombinator* sp., *Hyla* sp., *Triturus* sp., *Salamandra* sp., *Diemictylus viridescens* (Yamaguti, 1963), *Bo. bombina* (Buchvarov, 1977; Grabda-Kazubska & Lewin, 1989; Yıldırımhan *et al.*, 2001a), *Bo. variegata* (Buchvarov, 1977; Grabda-Kazubska & Lewin, 1989), *B. viridis* (Buchvarov, 1977; Yıldırımhan, 1999a; Vashetko & Siddikov, 1999; Shimalov & Shimalov, 2001; Düşen & Oğuz, 2010), *B. bufo* (Yıldırımhan & Karadeniz, 2007; Düşen, 2011), *B. calamita* (Shimalov & Shimalov, 2001); *H. arborea* (Düşen & Öz, 2004), *R. arvalis*, *R. dalmatina* (Buchvarov, 1977; Düşen *et al.*, 2009); *R. temporaria* (Buchvarov, 1977; Cedhagen, 1988; Kuc & Sulgostowska, 1988b), *R. esculenta* (Buchvarov, 1977; Kuc & Sulgostowska, 1988b), *R. macrocnemis* (Yıldırımhan *et al.*, 1997b; Yıldırımhan *et al.*, 2006b; Düşen, 2007), *R. camerani* (Yıldırımhan *et al.*, 2006a), *M. caucasica* (Yıldırımhan *et al.*, 2001b; 2005b), *R. kurtmuelleri* (Hristovski *et al.*, 2006), *R. tavasensis* (Düşen, 2012), *A. fragilis* (Shimalov *et al.*, 2000), *N. natrix* (Yamaguti, 1963; Shimalov & Shimalov, 2000).

Geographic range: Europe, U.S.A., Russia (Yamaguti, 1963); Turkey (Oğuz *et al.*, 1994).

Specimens deposited: PAU-HELM-16/2009

Family: Pomphorhynchidae

***Pomphorhynchus laevis* (Zoega in Müller 1776) (larvae and cysts)**

Prevalence, intensity and range: Hosts infected, 55 of 298 (18.45 %, 21.36 ± 1.33 SE, 1 – 79).

Other reported hosts: In general, *Pomphorhynchus laevis* occurs predominantly in cyprinid and also in salmonid fishes with the Palaearctic distribution (Dudiňák & Šnábel, 2001). *P. laevis*, is observed in several fish species in Turkey: barbel (*Barbus plebejus escherichii*), bleak (*Alburnus alburnus*), chub (*Leuciscus cephalus*), common carp (*Cyprinus carpio*), crucian carp (*Carassius carassius*), loach (*Nemachilus* sp.), nase (*Chondrostoma nasus*), pike (*Esox lucius*), sheatfish (*Silurus glanis*), (Öktener, 2003), and tench (*Tinca tinca*) (Yıldız, 2003). A number of marine and freshwater fishes have been reported as definitive hosts of acanthocephalan *P. laevis* (Ziolkowska & Rokicki, 2003). Buchvarov (1977) and Düşen and Oğuz (2008) observed in *Rana ridibunda* and Veith and Erpelding (1995) in fire salamander (*S. salamandra*) are reported *P. laevis*.

Geographic distribution: Europe Buchvarov (1977)

Specimens deposited: PAU-HELM-17/2009

Seventeen helminth species were found infecting *P. ridibundus*. The site of infection in the Eurasian marsh frog and the data on infection parameters for each host and helminth species are shown in Table 1. According the data

obtained 262 (87.91 %) *P. ridibundus* harbored the one or more species of helminths and the remaining 36 (%)12.08 were uninfected. In summary, 4311 individuals of 17 helminth species were collected from the 298 *P. ridibundus* were examined. Digeneans and nematodes were observed in both large-small intestines, lungs, rectum, mesenteries and organ surfaces; cestode and acanthocephalans were also observed in small intestine of *P. ridibundus*. There were 2.57 ± 1.56 (1 – 7 with a range from) helminth species per infected host and there were 14.46 helminth individuals per infected host (except *Abbreviata* sp., uncountable). The helminth species that were observed in *P. ridibundus*, are common parasites of European anurans and also, some reptiles (e.g. *E. colubrimurorum*), aquatic birds (e.g. *Eustrongylides* sp.) fishes (e.g. *P. laevis*) (Yamaguthi, 1958, 1961, 1963; Liang-Sheng, 1958; Buchvarov, 1977; Yıldırımhan, 1999; Anderson, 2000; Dudiňák & Šnábel, 2001; Düşen & Öz, 2006, Yıldırımhan *et al.*, 2007, Düşen *et al.*, 2010a; Düşen, 2012). *P. ridibundus* represents a new host record for *Nematotaenia dispar* in Turkey.

The present study on the helminthfauna on *P. ridibundus*, Eurasian marsh frog in Denizli province (inner-west Anatolia region Turkey), offers a contribution to the present knowledge in this field.

Acknowledgements

This study was supported by TÜBİTAK (The Scientific and Technical Research Council of Turkey) Project no: 107T917, and partly supported by the Pamukkale University Scientific Research Projects Unit Project no: 2008BSP005. We also thank, for permission and helps, the Department of National Parks and Wildlife of the Ministry of Environment and Forestry, of the Republic of Turkey.

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RECEIVED NOVEMBER 2, 2012

ACCEPTED DECEMBER 4, 2012