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Helminths of the Marsh Frog, *Rana ridibunda* Pallas, 1771 (Anura: Ranidae), from Antalya Province, Southwestern Turkey

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ABSTRACT: Marsh frogs (*Rana ridibunda*) were collected in Antalya province, southwestern Turkey, during 2001 and 2002 and examined for helminths. Of 258 frogs, 235 (91.1%) were infected with 1 or more helminths. The helminth fauna of *R. ridibunda* comprised 16 species: 10 species of trematodes (*Codonocephalus urnigerus* [metacercariae], *Diplodiscus subclavatus*, *Gorgodera cygnoides*, *Gorgoderina vitelliloba*, *Pleurogenoides medians*, *Prosotocus confusus*, *Brachycoelium salamandrae*, *Haematoloechus breviansa*, *Encyclometra colubrimurorum* [metacercariae], and *Opisthioglyphe ranae*), 5 species of nematodes (*Rhabdias bufonis*, *Cosmocerca commutata*, *Neoxysomatium* sp., *Eustrongylides* sp., and *Abbreviata* sp. [larvae]), and the acanthocephalan *Acanthocephalus ranae*. *Encyclometra colubrimurorum* (metacercariae), *B. salamandrae*, *Neoxysomatium* sp, *Eustrongylides* sp., and larval *Abbreviata* sp. represent new host records for *R. ridibunda* in Turkey.

KEY WORDS: Marsh frog, *Rana ridibunda*, helminths, Trematoda, Nematoda, Acanthocephala, Turkey.

The marsh frog, *Rana ridibunda* Pallas, 1771, is a medium-sized aquatic anuran species. It is diurnal and inhabits lakes, pools, or slowly flowing streams with much vegetation. It stays in proximity to water and prefers low plains or marshes. In Turkey, this species is known in all suitable habitats except for a portion of the Lakes District (Baran and Atatür, 1997).

Saygı and Başıbüyük (1990) reported *Gorgodera* sp., *Gorgoderina* sp., *Cosmocerca* sp., *Acanthocephalus* sp., and 1 unidentified trematode species (possibly a member of family Plagiiorchidae) from *R. ridibunda* in Sivas province (in Central Anatolia) Turkey. Oğuz et al. (1994) reported trematode and acanthocephalan species from *R. ridibunda* collected from the Bursa and Edirne provinces (northwestern Turkey), including *Acanthocephalus ranae* (Schrank, 1788) Lühe, 1911, *Pleurogenes claviger* (Looss, 1899), *Pleurogenoides medians* (Olsson, 1876) Travassos, 1921, and *Diplodiscus subclavatus* (Pallas, 1760) Diesing, 1836. Yıldırımhan et al. (1996a) presented a detailed investigation in the same region, including 11 trematodes (*Codonocephalus urnigerus* (Rudolphi, 1859) "metacercariae," *D. subclavatus* Diesing, 1836, *Gorgodera cygnoides* (Zeder, 1800), *Gorgoderina vitelliloba* (Olsson, 1876) Loos, 1902, *Candidotrema loosi* (Africa, 1930), *P. medians*, *Prosotocus confusus* (Loos, 1894) Loos, 1899, *Rauschiella* sp., *Haematoloechus variegatus* (Rudolphi, 1819), *Haematoloechus breviansa* (Sudarikov, 1950), *Opisthioglyphe ranae* (Froelich, 1791)), 3 nematodes (*Rhabdias bufonis* (Schrank, 1788), *Oswaldocruzia* sp., *Cosmocerca* sp.), and 1 acanthocephalan (*A. ranae*). Nothing has been published regarding helminths of *R. ridibunda* from Antalya province, southwestern Turkey.

MATERIALS AND METHODS

Frogs were collected by dip net and by hand between February 2001 and December 2002 from 13 localities in Antalya province in southwestern Turkey. In total, 258 *R. ridibunda* (147 males and 111 females) were examined for helminth parasites. The mean ± SD snout-vent length (SVL) of male specimens was 61.9 ± 13.1 mm, with a range from 30.5 to 95.7 mm, and mean ± SD SVL of females was 69.7 ± 20.9 mm, with a range from 31.2 to 112.5 mm.

Within 48 hr, frogs were overanesthesized in ether-filled glass containers. The body cavity was opened by a longitidunal 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 were 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 stereomicroscope.

Trematodes were immobilized by heat, fixed, and stored in 70% ethanol. Nematodes were straightened by heat, fixed, and stored in 70% ethanol with 5% glycerol. Acanthocephalans were relaxed in saline and heat-fixed under slight coverslip pressure in warm alcohol–formalin–acetic acid. Digeneans and acanthocephalans were stained with acetocarmine, dehydrated, cleared in cedar oil or xylol, and mounted in Canada balsam. Nematodes were cleared in glycerol and examined. Voucher specimens of parasites were deposited in the Ege University, Museum of Zoology, İzmir, Turkey. Parasite species were identified using Yamaguti (1958, 1961, 1963), Vojtkova and Vojtek (1975), Prudhoe and Bray (1982), Liang-Sheng (1958), Buchvarov (1977), and Yıldırımhan et al. (1996a). Intensities are presented as mean ± SD followed by the range.

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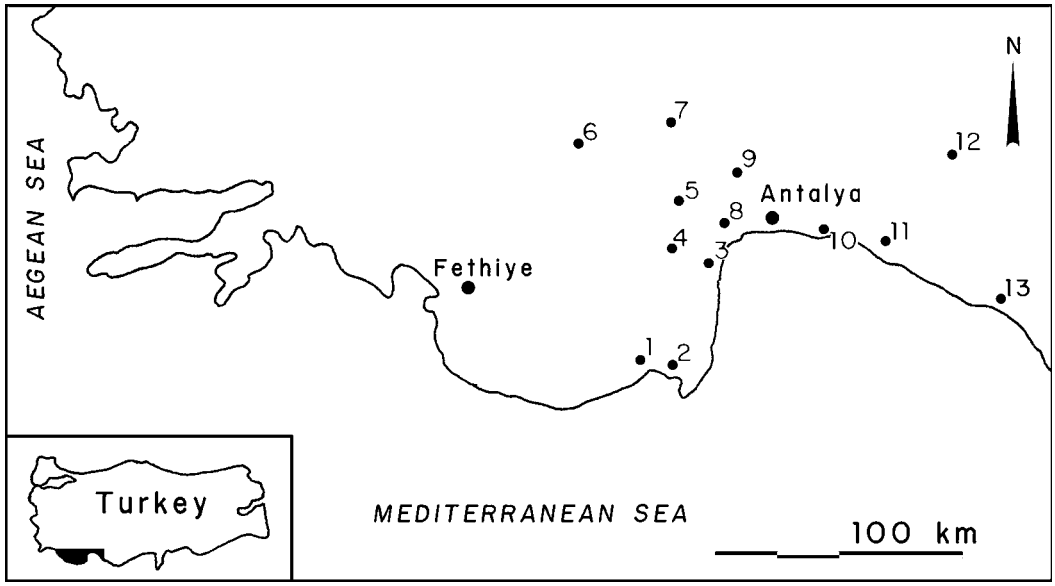

Figure 1. Collecting localities of *R. ridibunda* in southwest Turkey; elevations given in parentheses: **1.** Finike (15 m). **2.** Kumluca (5 m). **3.** Sarısu (10 m). **4.** Hisarçandır (1,250 m). **5.** Fesleğen Plateau (1,850 m). **6.** Lake Avlan (Elmalı) (1,080 m). **7.** Taşkesiği Village (Korkuteli) (1,515 m). **8.** Campus (30 m) **9.** Kırkgöz (300 m). **10.** Belek (Serik) (10 m). **11.** Denizyaka Village (Manavgat) (10 m). **12.** Akseki (625 m) **13.** Alanya (5 m).

Where sample sizes permitted, data collected from adult hosts were analyzed for prevalence between sexes using chi-square test, and for mean intensity between sexes using Student's *t*-test, and each host sex was examined for relationships between SVL and infection intensity by using linear regression analyses. Significant differences assume $P \leq 0.05$.

RESULTS

Rana ridibunda

Two hundred and fifty-eight marsh frogs were collected between February 2001 and December 2002 from 13 localities in Antalya province in southwestern Turkey (from 36°18′N, 30°09′E to 36°38′N, 32°02′E [Fig. 1]).

Trematoda

Codonocephalus urnigerus (Rudolphi, 1859) (metacercariae)

Prevalence and intensity: Hosts infected, 16 of 258 (6.2%); mean intensity 20 ± 30.6 (1–110).

Temporal distribution: November 2001, 4 hosts with 124; January 2002, 2 hosts with 119; February 2002, 4 hosts with 8; March 2002, 2 hosts with 20; April 2002, 4 hosts with 49.

Localities: Kumluca, Sarisu, Kirkgöz.

Sites of infection: Encysted in muscles, kidneys, liver, lung, spinal cord, testes, and ovary.

Other reported hosts: Rana esculenta (Yamaguti, 1958; Vojtková and Vojtek, 1975; Buchvarov, 1977); *Natrix natrix* (Yamaguti, 1958).

Geographic range: Europe (Yamaguti, 1958), Bulgaria (Buchvarov, 1977), Saudi Arabia (Fernando, 1989), Turkey (Yıldırımhan et al., 1996a), Iran (Mashaii, 1999; Mashaii et al., 2000), Africa (Niewiadomska, 2001).

Specimens deposited: ZDEU-HEL 1/2004 (1 slide).

Remarks

The definitive host of *C. urnigerus* is the little bittern (*Ixobrychus minitus*) (Yamaguti, 1958). This host species was frequently observed in *R. ridibunda* habitats in the survey area.

Diplodiscus subclavatus (Pallas, 1760) Diesing, 1836

Prevalence and intensity: Hosts infected, 5 of 258 (1.9%); mean intensity 2.6 ± 2.3 (1–6).

Temporal distribution: February 2002, 1 host with 1; March 2002, 3 hosts with 11; April 2002 1 host with 1.

Localities: Kirkgöz, Belek.

Site of infection: Large intestine.

Other reported hosts: Triturus cristatus, *B. viridis*, *Hyla arborea*, *Rana temporaria*, *Rana dalmatina*, *R. esculenta* (Vojtková and Vojtek, 1975; Buchvarov, 1977; Kuc and Sulgostowska, 1988b; Sey, 1991); *Bombina bombina*, *Bombina variegata* (Vojtková and Vojtek, 1975; Grabda-Kazubska and Lewin, 1989); *Triturus vulgaris*, *Pelobates syriacus balcanicus* (Buchvarov, 1977); *Triturus alpestris*, *Pelobates fuscus*, *R. lessonae* (Vojtková and Vojtek, 1975); *Bufo bufo*, *Rana arvalis* (Vojtková and Vojtek, 1975; Sey, 1991); *N. natrix* (Sey, 1991); pike, *Esox lucius* (Öztürk et al., 2000).

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

Specimens deposited: ZDEU-HEL 2/2004 (1 slide).

Remarks

Natrix natrix is probably a paratenic host.

Gorgodera cygnoides (Zeder, 1800)

Prevalence and intensity: Hosts infected, 51 of 258 (19.8%); mean intensity 4.4 ± 5.4 (1–24).

Temporal distribution: March 2001, 3 hosts with 7; April 2001, 6 hosts with 33; May 2001, 8 hosts with 23; June 2001, 8 hosts with 92; September 2001, 7 hosts with 22; November 2001, 7 hosts with 27; January 2002, 2 hosts with 5; February 2002, 1 host with 1; March 2002, 4 hosts with 7; May 2002, 2 hosts with 4; June 2002, 1 host with 3; November 2002, 2 hosts with 2.

Localities: Finike, Kumluca, Sarisu, Fesleğen Plateau, Lake Avlan, Taşkesiği Village, Campus, Kirkgöz, Belek, Akseki.

Site of infection: Urinary bladder.

Other reported hosts: Rana clamitans, *H. arborea*, *Bombinator igneus* (Yamaguti, 1958); *R. temporaria* (Yamaguti, 1958; Vojtková and Vojtek, 1975); *R. esculenta* (Yamaguti, 1958; Vojtková and Vojtek, 1975; Buchvarov, 1977; Kuc and Sulgostowska, 1988b); *B. bombina*, *B. variegata*, *R. arvalis*, *R. lessonae* (Vojtková and Vojtek, 1975); *B. viridis* (Buchvarov, 1977).

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

Specimens deposited: ZDEU-HEL 3/2004 (1 slide).

Gorgoderina vitelliloba (Olsson, 1876) Loos, 1902

Prevalence and intensity: Hosts infected, 15 of 258 (6.2%); mean intensity 4.3 ± 6.0 (1–23).

Temporal distribution: March 2001, 3 hosts with 4; April 2001, 1 host with 1; May 2001, 4 hosts with 16; June 2001, 2 hosts with 28; October 2001, 1 host with 8; February 2002, 1 host with 1; March 2002, 3 hosts with 3; May 2002, 1 host with 5.

Localities: Finike, Hisarçandir, Fesleğen Plateau, Lake Avlan, Taşkesiği Village, Belek.

Site of infection: Urinary bladder.

Other reported hosts: B. igneus (Yamaguti, 1958); *R. arvalis* (Yamaguti, 1958; Vojtková and Vojtek, 1975); *B. variegata*, *R. temporaria* (Yamaguti, 1958; Vojtková and Vojtek, 1975; Buchvarov, 1977); *R. esculenta*, *B. bombina* (Vojtková and Vojtek, 1975); *B. viridis*, *R. dalmatina* (Buchvarov, 1977); *Rana macronemis* (Yıldırımhan et al., 1997b).

Geographic range: Europe and Asia minor (Yamaguti, 1958), Czech Republic (Vojtková and Vojtek, 1975), Bulgaria (Buchvarov et al., 1975; Buchvarov, 1977), Turkey (Yıldırımhan et al., 1996a).

Specimens deposited: ZDEU-HEL 4/2004 (1 slide).

Pleurogenoides medians (Olsson, 1876) Travassos, 1921

Prevalence and intensity: Hosts infected, 47 of 258 (18.2%); mean intensity 34.2 ± 44.6 (1–185).

Temporal distribution: April 2001, 1 host with 2; May 2001, 4 hosts with 105; November 2001, 5 hosts with 257; January 2002, 5 hosts with 260; February 2002, 1 host with 10; March 2002, 8 hosts with 420; April 2002, 7 hosts with 324; May 2002, 10 hosts with 141; June 2002, 6 hosts with 90.

Localities: Finike, Sarisu, Hisarçandir, Fesleğen Plateau, Taşkesiği Village, Campus, Kirkgöz, Belek.

Site of infection: Small intestine.

Other reported hosts: Bufo vulgaris (Yamaguti, 1958); *T. vulgaris*, *B. bombina*, *B. bufo*, *B. viridis*, *Bufo calamita*, *R. arvalis* (Vojtková and Vojtek, 1975); *R. esculenta* (Vojtková and Vojtek, 1975; Buchvarov, 1977; Kuc and Sulgostowska, 1988b); *R. temporaria* (Vojtková and Vojtek, 1975; Cedhagen, 1988); *R. dalmatina* (Buchvarov, 1977); *Lacerta trilineata* (Yıldırımhan, 1999: unpublished Ph.D. thesis, Uludağ University, Bursa, Turkey); *Rana camerani* (Düşen, 2003: unpublished Ph.D. thesis, Akdeniz University, Antalya, Turkey); *H. arborea* (Vojtková and Vojtek, 1975; Düşen and Öz, 2004).

Geographic range: Europe, Asia (Yamaguti, 1958); Austrolasian Region (Prudhoe and Bray, 1982).

Specimens deposited: ZDEU-HEL 5/2004 (1 slide).

Prosotocus confusus (Loos, 1894) Loos, 1899

Prevalence and intensity: Hosts infected, 12 of 258 (4.7%); mean intensity 26.4 ± 23.1 (3–75).

Temporal distribution: January 2002, 2 hosts with 25; February 2002, 3 hosts with 51; March 2002, 7 hosts with 241.

Localities: Finike, Kumluca, Belek.

Site of infection: Small intestine.

Other reported hosts: R. esculenta (Yamaguti, 1958; Vojtková and Vojtek, 1975; Buchvarov, 1977; Kuc and Sulgostowska, 1988b); *B. viridis* (Yamaguti, 1958; Vojtková and Vojtek, 1975); *B. vulgaris* (Yamaguti, 1958); and *B. variegata*, *B. bufo*, *B. calamita*, *H. arborea*, *R. temporaria*, *R. arvalis* (Vojtková and Vojtek, 1975).

Geographic range: Europe and Asia (Yamaguti, 1958).

Specimens deposited: ZDEU-HEL 6/2004 (1 slide).

Brachycoelium salamandrae (Froelich, 1789)

Prevalence and intensity: Hosts infected, 1 of 258 (0.4%).

Temporal distribution: January 2002, 1 host with 1.

Locality: Kirkgöz.

Site of infection: Small intestine.

Other reported hosts: Triturus sp., *Desmognathus* sp., *Eurycea* sp., *Plethodon* sp., *Salamandra atra*, *Salamandra maculosa*, *Bufo* sp., *Rana* sp., *Terrapene* sp., *Pseudoacris* sp., *Hyla* sp., *Anguis fragilis* (Yamaguti, 1958); *T. alpestris* (Vojtková and Vojtek, 1975; Buchvarov, 1977); *Salamandra salamandra*, *T. vulgaris*, *T. cristatus*, *R. temporaria* (Vojtková and Vojtek, 1975); *Taricha granulosa* (Moravec, 1984); *Euproctus montanus* (Knoepffler and Combes, 1988); *Mertensiella caucasica* (Yıldırımhan et al., 2001b).

Geographic range: Europe, U.S.A., Canada, Africa (Yamaguti, 1958); Turkey (Yıldırımhan et al., 2001b).

Specimens deposited: ZDEU-HEL 7/2004 (1 slide).

Remarks

Rana ridibunda represents a new host record for *B. salamandra* in Turkey. Yıldırımhan et al. (2001b) recorded this helminth in *M. caucasica* from Trabzon province in northeastern Turkey.

Haematoloechus breviansa (Sudarikov, 1950)

Prevalence and intensity: Hosts infected, 47 of 258 (18.2%); mean intensity 2.4 ± 2.0 (1–12).

Temporal distribution: February 2001, 1 host with 1; March 2001, 6 hosts with 10; April 2001, 5 hosts with 8; May 2001, 6 hosts with 11; June 2001, 3 hosts with 9; October 2001, 3 hosts with 6; November 2001, 4 hosts with 15; January 2002, 4 hosts with 6; February 2002, 5 hosts with 14; March 2002, 2 hosts with 4; April 2002, 4 hosts with 9; September 2001, 3 hosts with 14; December 2002, 1 host with 4.

Localities: Finike, Sarisu, Fesleğen Plateau, Lake Avlan, Taşkesiği Village, Campus, Kirkgöz, Belek, Denizyaka Village, Akseki.

Site of infection: Lung.

Geographic range: Russia (Yamaguti, 1958), Iran (Mashaii et al., 2000), Turkey (Yıldırımhan et al., 1996a).

Specimens deposited: ZDEU-HEL 8/2004 (1 slide).

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

Prevalence and intensity: Hosts infected, 11 of 258 (4.3%); mean intensity 8.5 ± 8.9 (1–28).

Temporal distribution: January 2002, 3 hosts with 35; February 2002, 4 hosts with 16; May 2002, 3 hosts with 14; August 2002, 1 host with 28.

Localities: Kirkgöz, Belek.

Sites of infection: Encysted in muscles, kidneys, liver, lung, spinal cord, testes, and ovary.

Other reported hosts: Xenochnopis piscator, *N. natrix*, *Coluber gemonensis*, *Ptyas mucosus*, *Rana tigrina* (Yamaguti, 1958); *B. bombina*, *P. fuscus*, *B. viridis*, *R. dalmatina*, *R. temporaria* (Vojtková and Vojtek, 1975); *R. esculenta* (Buchvarov, 1977); *H. arborea* (Vojtková and Vojtek, 1975; Düşen and Öz, 2004).

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

Specimens deposited: ZDEU-HEL 9/2004 (1 slide).

Remarks

Rana ridibunda represents a new host record for *E. colubrimurorum* in Turkey. Vojtková and Vojtek (1975), Buchvarov (1977), and Masshai et al. (2000) recorded this trematode in *R. ridibunda* from Czech Republic, Bulgaria, and Iran, respectively. The definitive host of *E. colubrimurorum* is grass snake (*N. natrix*) (Liang-Sheng, 1958). This host species were frequently observed in the *R. ridibunda* habitats in the survey area.

Opisthioglyphe ranae (Froelich, 1791)

Prevalence and intensity: Hosts infected, 17 of 258 (6.6%); mean intensity 9.1 ± 10.0 (1–32).

Temporal distribution: March 2001, 1 host with 2; January 2002, 2 hosts with 30; February 2002, 2 hosts with 3; March 2002, 3 hosts with 10; April 2002, 4 hosts with 69; May 2002, 3 hosts with 29; August 2002, 2 hosts with 12.

Localities: Sarisu, Kirkgöz.

Site of infection: Small intestine.

Other reported hosts: S. maculosa, *T. cristatus*, *B. vulgaris*, *Bufo variabilis*, *B. calamita* (Yamaguti, 1958); *B. viridis*, *R. dalmatina* (Vojtková and Vojtek, 1975; Buchvarov, 1977); *R. temporaria*, *R. esculenta* (Yamaguti, 1958; Vojtková and Vojtek, 1975; Buchvarov, 1977); *B. variegata*, *P. fuscus*, *H. arborea* (Vojtková and Vojtek, 1975); *B. bombina* (Vojtková and Vojtek, 1975; Yıldırımhan et al., 2001a).

Geographic range: Europe (Yamaguti, 1958), Turkey (Yıldırımhan et al., 1996a), Saudi Arabia (Fernando, 1989), Iran (Masshai et al., 2000).

Specimens deposited: ZDEU-HEL 10/2004 (1 slide).

Nematoda

Rhabdias bufonis (Schrank, 1788) Stiles and Hassal, 1905

Prevalence and intensity: Hosts infected, 30 of 258 (11.6%); mean intensity 3.3 ± 2.9 (1–23).

Temporal distribution: February 2001, 1 host with 1; March 2001, 3 hosts with 12; May 2001, 6 hosts with 19; April 2001, 3 hosts with 16; October 2001, 2 hosts with 3; February 2002, 6 hosts with 9; March 2002, 3 hosts with 7; April 2002, 5 hosts with 27; December 2002, 1 host with 5.

Localities: Finike, Sarisu, Hisarçandir, Campus, Belek, Denizyaka Village, Akseki.

Site of infection: Lung.

Other reported hosts: Bufo sp., *Rana* sp., *Pelobates* sp., *Bominator* sp., *A. fragilis* (Yamaguti, 1961); *B. bombina* (Grabda-Kazubska and Lewin, 1989; Yıldırımhan et al., 2001a); *R. esculenta* (Buchvarov, 1977; Kuc and Sulgostowska, 1988b); *R. temporaria*, *R. arvalis* (Kuc and Sulgostowska, 1988b; Cedhagen, 1988); *B. viridis* (Buchvarov et al., 1975; Buchvarov, 1977; Yıldırımhan, 1999); *R. dalmatina* (Buchvarov et al., 1975; Buchvarov, 1977); *B. variegata*, *P. syriacus* (Buchvarov, 1977); *B. bufo* (Buchvarov, 1977; Yıldırımhan et al., 1997a).

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

Specimens deposited: ZDEU-HEL 11/2004 (1 slide).

Cosmocerca commutata (Diesing, 1861)

Prevalence and intensity: Hosts infected, 131 of 258 (50.8%); mean intensity 6.9 ± 8.1 (1–62).

Temporal distribution: January 2001, 1 host with 2; February 2001 3 hosts with 34; March 2001, 5 hosts with 24; April 2001, 12 hosts with 90; May 2001, 11 hosts with 64; June 2001, 13 hosts with 98; July 2001, 4 hosts with 102; September 2001, 14 hosts with 68; October 2001, 2 hosts with 8; November 2001, 7 hosts with 55, January 2002, 9 hosts with 30; February 2002, 5 hosts with 14; March 2002, 6 hosts with 34; April 2002, 10 hosts with 62; May 2002, 15 hosts with 88; June 2002, 3 hosts with 6; August 2001, 1 host with 55; August 2002, 3 hosts with 27; September 2002, 3 hosts with 18; October 2002, 4 hosts with 22.

Localities: Finike, Kumluca, Sarisu, Hisarçandir, Fesleğen Plateau, Lake Avlan, Taşkesiği Village, Campus, Kirkgöz, Belek, Denizyaka Village, Akseki, Alanya.

Site of infection: Large intestine.

Other reported hosts: S. salamandra, *B. bombina*, *B. variegata*, *B. bufo*, *R. temporaria*, *Rana graeca* (Buchvarov, 1977); *B. viridis* (Yamaguti, 1961; Buchvarov, 1977; Yıldırımhan, 1999); *R. dalmatina* (Buchvarov et al., 1975; Buchvarov, 1977); *H. arborea* (Düşen and Öz, 2004).

Geographic range: Europe (Yamaguti, 1961), Turkey (Yıldırımhan, 1999).

Specimens deposited: ZDEU-HEL 12/2004 (1 slide).

Neoxysomatium sp.

Prevalence and intensity: Hosts infected, 50 of 258 (19.4%); mean intensity 13.2 ± 15.4 (1–65).

Temporal distribution: March 2001, 2 hosts with 10; April 2001, 9 hosts with 48; May 2001, 10 hosts with 162; June 2001, 3 hosts with 45; September 2001, 6 hosts with 220; October 2001, 5 hosts with 59; November 2001, 2 hosts with 28; February 2002, 4 hosts with 10; March 2002, 2 hosts with 3; April 2002, 4 hosts with 16; May 2002, 3 hosts with 53.

Localities: Finike, Kumluca, Sarisu, Hisarçandir, Fesleğen Plateau, Taşkesiği Village, Campus, Kirkgöz, Akseki.

Site of infection: Large intestine.

Specimens deposited: ZDEU-HEL 13/2004 (1 slide).

Remarks

Rana ridibunda represents a new host record for *Neoxysomatium* sp. in Turkey. Yıldırımhan et al. (1997a) reported this nematode in *B. Bufo* and *P. syriacus* from the Bursa region. Azimov and Ikramov (2001) recorded this nematode in *R. ridibunda* from Uzbekistan.

Eustrongylides sp.

Prevalence and intensity: Hosts infected, 3 of 258 (1.2%), each infected with a single worm.

Temporal distribution: Februray 2001, 1 host with 1; April 2001, 2 hosts with 2.

Localities: Sarisu, Belek.

Site of infection: Encysted on intestinal tract.

Specimens deposited: ZDEU-HEL 14/2004 (1 slide).

Remarks

Rana ridibunda represents a new host record for *Eustrongylides* sp. in Turkey. *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 Aydoğdu et al. (1996a, b, 1997, 2000) recorded this nematode larvae in *N. natrix*, roach (*Rutilus frisii*), sheatfish (*Silurus glanis*), and tench (*Tincta tincta*) from Lake İznik (Bursa). Anderson (1992) stated that the larvae of this nematode is observed in *R. ridibunda* (cited in Aydoğdu et al., 1996a).

Abbreviata sp. (larvae)

Prevalence and intensity: Hosts infected, 15 of 258 (5.8%); intensity not determined.

Temporal distribution: April 2001, 7 hosts; September 2001, 5 hosts; January 2002, 2 hosts; April 2002, 1 host.

Localities: Kumluca, Hisarçandir, Taşkesiği Village, Kirkgöz, Belek.

Site of infection: Encapsulated larvae in submucosa of stomach and small intestine.

Specimens deposited: ZDEU-HEL 15/2004 (1 slide).

Remarks

Rana ridibunda represents a new host record for *Abbreviata* sp. in Turkey. Many larvae of *Abbreviata* sp. (6%) were observed embedded deeply in submucosa of the stomach and small intestine making counting difficult. Yıldırımhan (1999: unpublished Ph.D. thesis, Uludağ University, Bursa, Turkey) reported this nematode's adult forms in the three-lined emerald lizard (*Lacerta trilineata*) from Bursa region. Fernando (1989) recorded this nematode in *R. ridibunda* from Saudi Arabia.

Acanthocephala

Acanthocephalus ranae (Schrank, 1788) Lühe, 1911

Prevalence and intensity: Hosts infected, 24 of 258 (9.3%); mean intensity 8.7 ± 14.1 (1–52).

Temporal distribution: April 2001, 14 hosts with 29; June 2001, 3 hosts with 54; September 2001, 6 hosts with 125; June 2002, 1 host with 1.

Locality: Taşkesiği Village.

Site of infection: Small intestine.

Other reported hosts: Rana sp., *Bombinator* sp., *Hyla* sp., *Triturus* sp., *Salamandra* sp., *Diemictylus viridescens*, *N. natrix* (Yamaguti, 1963); *B. bombina* (Buchvarov, 1977; Grabda-Kazubska and Lewin, 1989; Yıldırımhan et al., 2001a); *B. variegata* (Grabda-Kazubska and Lewin, 1989); *R. dalmatina* (Buchvarov, 1977); *B. viridis* (Buchvarov, 1977; Yıldırımhan, 1999); *H. arborea* (Düşen and Öz, 2004); *R. arvalis*, *R. temporaria* (Buchvarov, 1977; Cedhagen, 1988; Kuc and Sulgostowska, 1988b); *R. esculenta* (Buchvarov, 1977; Kuc and Sulgostowska, 1988b); *R. macrocnemis* (Yıldırımhan et al., 1997b; Düşen, 2003: unpublished Ph.D. thesis, Akdeniz University, Antalya, Turkey).

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

Specimens deposited: ZDEU-HEL 16/2004 (1 slide).

DISCUSSION

Two hundred and thirty-five (91.1%) of *R. ridibunda* (132 males, 103 females) harbored 4,777 helminths in total. (The total number of *Abbreviata* sp. [larvae] is not included this calculation, because counting was difficult.) Sixteen helminth species were found: 10 trematodes (8 adults, 2 metacercariae), 5 nematodes, and 1 acanthocephalan. Although 16 species were present in the sample, no host contained more than 6 species: 87 (33.3%) of 235 *R. ridibunda* harbored 1 species, 79 (30.6%) harbored 2 species, 43 (16.7%) harbored 3 species, 21 (8.1%) harboured 4 species, 4 (1.5%) harbored 5 species, and 1 (0.4%) harbored 6 species. There was a mean of 2.0 ± 1.1 helminth species per infected host and 20.3 ± 19.0 helminths per infected host.

The prevalence of *R. bufonis* was significantly greater in male (17.7%) than in female (3.6%) frogs ($\chi^2 = 12.21$; 1 df). No other significant differences were detected in prevalence between sexes. The mean intensity of *P. medians* was significantly greater in females (45.8) than males (19.9; $t = 2.2$; 34 df). The mean intensity of *H. breviansa* was significantly greater in males (2.9) than in females (1.5; $t = 3.0$; 33 df). The mean intensity of *C. commutata* was significantly greater in females (9.4) than in males (4.8; $t = 3.1$; 68 df). No other significant differences were detected in mean intensity between male and female frogs.

Significant positive correlations were detected in SVL of adult male frogs and intensity *G. vitelliloba* ($r = 0.56$) and adult female frogs and intensity *C. urnigerus* metacercariae, *G. vitelliloba*, *C. commutata*, *Neoysomatium* sp., and *A. ranae* ($r = 0.60$, 0.65, 0.38, 0.49, and 0.44, respectively). Significant negative correlations were detected in SVL of adult male frogs and intensity of *O. ranae* ($r = –0.51$) and adult female frogs and intesity of *P. confusus* and *E. colubrimurorum* metacercariae ($r = –0.79$ and 0.70, respectively). This represents the first survey of helminths of *R. ridibunda* from Antalya province in southwestern Turkey. *Encyclometra colubrimurorum* (metacercariae), *B. salamandrae*, *Neoxysomatium* sp., *Eustrongylides* sp., and *Abbreviata* sp. (larvae) are reported for the first time from *R. ridibunda* in Turkey. With a few exceptions, the helminth fauna of southwestern Turkey is very similar to that reported by Yıldırımhan et al. (1996a) for northwestern Turkey. In both investigations, *C. commutata* was the most prevalent parasite of frogs, although *L. medians* exhibited higher mean intensities in both investigations. *Neoxysomatium* sp. exhibited a higher prevalence in this study than by Yıldırımhan et al. (1996a). *Brachycoelium salamandrae*, *E. colubrimurorum* (metacercariae), *Eustrongylides* sp., and *Abbreviata* sp. (larvae) were not recorded by Yıldırımhan et al. (1996a). Helminths observed by Yildirmhan et al. (1996a), not observed in this study were *Rauschiella* sp., *Haematoloechus variegatus*, *Canditotrema loosi*, and *Oswaldocruzia* sp.

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