

Helminth Parasites of the Agile Frog, *Rana dalmatina* Fitzinger, 1839 (Anura: Ranidae), Collected from Two Localities in Turkey

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Abstract: A total of 32 agile frogs, *Rana dalmatina* Fitzinger, 1839, were collected from two localities (Trabzon and Yalova Provinces) between 1998-2008 and studied for the presence of helminth parasites. The following species were recorded: one species of Monogenea (*Polystoma mazurmovici*), three species of Digenea (*Gorgodera cygnoides*, *Pleurogenoides medians* and *Haplometra cylindracea*), four species of Nematoda (*Rhabdias bufonis*, *Oswaldocruzia filiformis*, *Cosmocerca ornata* and *Oxysomatium brevicaudatum*), and one species of Acanthocephala (*Acanthocephalus ranae*). *Rana dalmatina* represents a new host record for *Polystoma mazurmovici* and *Gorgodera cygnoides* in Turkey. Turkey is a new geographical record for *Haplometra cylindracea*. A checklist of helminth parasites recorded from *Rana dalmatina* throughout its geographical range is presented.

Key words: helminth, agile frog, *Rana dalmatina*, Turkey

Introduction

The agile frog, *Rana dalmatina* Fitzinger, 1839, is a medium-sized, strictly terrestrial anuran species living up to 1500 m a.s.l. in deciduous forests or damp grasslands with high vegetation, usually quite far from water bodies (BARAN & ATATÜR 1998). This species is mainly a nocturnal insectivore and in Turkey is found in Thrace and the northern parts of Anatolia (BARAN & ATATÜR 1998). Previous reports have identified helminth species from *R. dalmatina* collected in Bulgaria (BUCHVAROV 1962, 1965; BUCHVAROV *et al.* 1975; KIRIN & BUCHVAROV 2002a,b), former Czechoslovakia (PROKOPIC 1957; VOLNA-NABELKOVA 1964; KOZÁK 1969, 1973; MORAVEC & VOJTKOVÁ 1974; PROKOPIC & KRIVANEC 1975; VOJTKOVÁ 1976; MORAVEC & SCHOLZ 1991), Denmark (FRANSEN 1974), France (JOYEUX & BAER 1936; BAKER 1980; JONES 1987), Turkey (DÜŞEN *et al.* 2009) and former Yugoslavia (HRISTOVSKI 1973; ROZMAN 1976).

The present article is the second report of helminth parasites from *R. dalmatina* collected in Turkey. We also aim to present a list of helminth species recorded from *Rana dalmatina* throughout its geographical range, including two new parasite records and one new geographical record for helminths from this host species in Turkey.

Materials and Methods

Thirty-two specimens of *Rana dalmatina* were collected by hand from two localities: (i) Yalova Province (40°39'N, 29°15'E), Çınarcık County (nine females, 13 males, Snout-Vent Length (SVL) = 53.4 mm ± 3.7 SD, range 48-60 mm), collected in March 1998 (N=3), April 2000 (N=2), December 2004 (N=5), June 2005 (N=4), May 2006 (N=5), May 2008 (N=3); (ii) Trabzon Province (41°00'N, 39°43'E),

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Çaykara County (seven females, three males, SVL = 54.7 mm ± 3.5 SD, range 50-60 mm) collected in July 2001 (N=2), July 2002 (N=3), July 2004 (N=5).

The frogs were examined within one week of capture. They were over-anaesthetised with sodium pentobarbital, the body cavity was opened through an incision from vent to throat, and the abdominal cavity, stomach, intestine, heart, lungs, liver, urinary bladder and mouth were examined separately for helminths using a dissecting microscope. Helminths were killed in hot saline solution; nematodes were fixed in 70% ethanol and mounted in glycerol; Monogenans were fixed in 70% ethanol, stained with iron-carmin (GEORGIEV *et al.* 1986), cleared in clove oil and mounted in Entellan® for examination with a compound microscope. Identifications are done following RYZHIKOV *et al.* (1980) and PRUDHOE & BRAY (1982). Voucher specimens were deposited in the helminth collection of Uludag University Museum of Zoology, Bursa, Turkey. Frog specimens were deposited at the Department of Biology, Uludag University, Bursa, Turkey. Anuran nomenclature follows FROST (2013) with the exception of the edible frog, *Pelophylax esculentus*, a name we have retained (see POPIOEK *et al.* 2011).

Results

MONOGENEA

Polystomatidae

Polystoma mazurmovici Buchvarov, 1980

Prevalence and intensity: 1 infected out of 32 hosts studied (3%, 1).

Temporal distribution: Çınarcık: 7 December 2004, 1 host with 1 parasite.

Site of infection: Urinary bladder.

Additional reports from Turkey: None.

Type host and locality: *Rana dalmatina*, Bulgaria (BUCHVAROV 1980).

Other reported hosts: None.

Geographic range: Bulgaria (BUCHVAROV 1980); Turkey (present study).

Specimens deposited: Uludag University Museum of Zoology.

Remarks: DÜŞEN *et al.* (2009) reported a species of *Polystoma* to be present in *R. dalmatina* from Turkey (specific locality not stated). Four species of *Polystoma* have been previously reported from Turkey: *Polystoma integerrimum* in the lemon-yellow tree frog (*Hyla savignyi*); *Polystoma macrocnemis* in the Uludag frog (*Rana macrocnemis*); *Polystoma skrjabini* in the European tree frog (*Hyla arborea*); and *Polystoma viridis* in the green toad (*Bufotes viridis*) (YILDIRIMHAN 1999; BISERKOV *et al.*

2001; DÜŞEN & ÖZ 2004; YILDIRIMHAN *et al.* 2012). Three additional species of *Polystoma* have been reported from various localities in Europe, and namely *Polystoma gallieni* from France and Spain (COMBES 1968; GALEANO *et al.* 1990), *Polystoma mazurmovici* from Bulgaria (BUCHVAROV 1980), and *Polystoma pelobatis* from France (COMBES 1968). DÜŞEN *et al.* (2009) were unable to identify the species collected in their study because the specimens were juvenile. Given the study of DÜŞEN *et al.* (2009) and our current findings, we would suggest that this is actually the second record of *P. mazurmovici* in *R. dalmatina*; however, *R. dalmatina* represents a new host record for *P. mazurmovici* from Turkey and a new geographical record.

DIGENEA

Gorgoderidae

Gorgodera cygnoides (Zeder, 1800)

Prevalence and intensity: 2 infected out of 32 hosts studied (6%, 2).

Temporal distribution: Çaykara: 15 July 2003, 1 host with 2. 18 July 2004, 1 host with 2 parasites.

Site of infection: Urinary bladder.

Type host and locality: *Pelophylax esculentus*, Europe (ZEDER 1800).

Geographic range: Western Europe (YAMAGUTI 1958).

Specimens deposited: Uludag University Museum of Zoology.

Remarks: *Gorgodera cygnoides* is currently known only from anurans. This is the second report of *G. cygnoides* from *R. dalmatina*. *Gorgodera cygnoides* was previously reported in *R. dalmatina* collected in Bulgaria (BUCHVAROV 1977). However, this is the first report of *G. cygnoides* in *R. dalmatina* collected in Turkey.

Lecithodendriidae

Pleurogenoides medians (Olsson, 1876)

Prevalence, mean intensity and range: 2 infected out of 32 hosts studied (6%, 4.5 ± 0.7, 4-5).

Temporal distribution: Çaykara: 18 July 2004, 2 hosts with 4 and 5 parasite individuals.

Site of infection: Intestine.

Type host and type locality: *Bufotes viridis*, Denmark (OLSSON 1876).

Geographic range: Western Europe (YAMAGUTI 1971).

Remarks: *Pleurogenoides medians* has been reported from *R. dalmatina* collected in Bulgaria (BUCHVAROV 1977), former Czechoslovakia (KOZÁK 1973; VOJTKOVÁ & VOTJEK 1975) and Turkey (DÜŞEN *et al.* 2009).

Plagiorchiidae

Haplometra cylindracea (Zeder, 1800)

Prevalence, mean intensity and range: 6 infected out of 32 hosts studied (19%, 5.93 ± 2.51 , 4-8).

Temporal distribution: Çaykara: 11 July 2001, 1 host with 8; 15 July 2002, 2 hosts with 4 and 5, respectively; 18 July 2004, 3 hosts with 4 each.

Site of infection: Lungs.

Type host and type locality: *Pelophylax esculentus*, Europe (ZEDER 1800).

Geographic range: Palearctic region (PRUDHOE & BRAY 1982).

Specimens deposited: Uludag University Museum of Zoology.

Remarks: *Haplometra cylindracea* is currently known only from anurans and has been previously reported from *R. dalmatina* collected in former Czechoslovakia (PROKOPIC 1957; KOZÁK 1973; PROKOPIC & KRIVANEC 1975) and Denmark (FRANDSEN 1974). This is the first report of *H. cylindracea* from *R. dalmatina* collected in Turkey

NEMATODA

Rhabdiasidae

Rhabdias bufonis (Schrank, 1788)

Prevalence, mean intensity and range: 10 infected out of 32 hosts studied (31.25%, 4.6 ± 2.12 , 2-7).

Temporal distribution: Çaykara: 11 July 2001, 2 hosts with 5, 7, respectively; 15 July 2002, 3 hosts with 5, 5, 6, respectively; 18 July 2004, 5 hosts with 2, 3, 3, 4, 4, respectively.

Site of infection: Lung.

Type host and locality: Frog (unidentified), Germany (SCHRANK 1788).

Geographic range: Western Europe (BAKER 1987), Africa (AISIEU *et al.* 2003).

Specimens deposited: Uludag University Museum of Zoology.

Remarks: *Rhabdias bufonis* is the common anuran lungworm in Western Europe (see BAKER 1987) and has been previously reported in *R. dalmatina* collected in Bulgaria (BUCHVAROV 1962), former Czechoslovakia (VOLNA-NABELKOVA 1964; KOZÁK 1969, 1973; PROKOPIC & KRIVANEC 1975; VOJTKOVÁ 1976), Denmark (FRANDSEN 1974), and Turkey (DÜŞEN *et al.* 2009).

Molineidae

Oswaldocruzia filiformis (Goeze, 1782)

Prevalence, mean intensity and range: 26 infected out of 32 hosts studied (81.25%, 5.46 ± 3.04 , 1-16).

Temporal distribution: Çınarcık: 13 March 1998, 3 hosts with 1, 1, 2, respectively; 27 April

2000, 1 host with 1; 7 December 2004, 4 host with 1, 1, 2, 3, respectively; 7 June 2005, 3 hosts with 1, 2, 2, respectively; 20 May 2006, 2 hosts with 1, 1, respectively; 25 May 2008 3 hosts with 1, 2, 2, respectively. Çaykara: 11 July 2001, 2 hosts with 8, 16, respectively; 15 July 2002, 3 hosts with 7, 10, 13, respectively; 18 July 2004, 5 hosts with 10, 12, 12, 14, 16, respectively.

Site of infection: Small intestine.

Type host and locality: *Rana temporaria*, Europe (GOEZE 1782).

Specimens deposited: Uludag University Museum of Zoology.

Geographic range: Europe (BAKER 1987).

Remarks: *Oswaldocruzia filiformis* has previously been reported from *R. dalmatina* collected in Bulgaria (BUCHVAROV 1962; BUCHVAROV *et al.* 1975; KIRIN & BUCHVAROV 2002b), former Czechoslovakia (PROKOPIC 1957; VOLNA-NABELKOVA 1964; KOZÁK 1969, 1973; PROKOPIC & KRIVANEC 1975; VOJTKOVÁ 1976; MORAVEC & SCHOLZ 1991), Denmark (FRANDSEN 1974), former Yugoslavia (ROZMAN 1976) and Turkey (DÜŞEN *et al.* 2009).

Cosmocercidae

Cosmocerca ornata (Dujardin, 1845)

Prevalence, mean intensity and range: 12 infected out of 32 hosts studied (37.5%, 3.75 ± 1.91 , 1-6).

Temporal distribution: Çınarcık: 13 March 1998, 2 hosts with 1,1, respectively. Çaykara: 11 July 2001, 2 hosts with 4, 6, respectively; 15 July 2002, 3 hosts with 2, 3, 6, respectively; 18 July 2004, 5 hosts with 2, 4, 5, 5, 6, respectively.

Site of infection: Large intestine.

Type host and locality: *Pelophylax esculentus*, Western Europe (DUJARDIN 1845).

Geographic range: Western Europe, (BAKER 1987); Africa (AISIEU *et al.*, 2003)

Specimens deposited: Uludag University Museum of Zoology

Remarks: *Cosmocerca ornata* has previously been reported from *R. dalmatina* collected in Bulgaria (BUCHVAROV 1962, 1965), former Czechoslovakia (PROKOPIC 1957; VOLNA-NABELKOVA 1964; KOZÁK 1969, 1973; MORAVEC & VOJTKOVÁ 1974; PROKOPIC & KRIVANEC 1975; VOJTKOVÁ 1976), Denmark (FRANDSEN 1974), and Turkey (DÜŞEN *et al.* 2009).

Oxysomatium brevicaudatum (Zeder, 1800)

Prevalence, mean intensity and range: 15 infected out of 32 hosts studied (46.87%, 2.2 ± 2.64 , 1-7).

Temporal distribution: Çınarcık: 11 March 1998, 1 host with 1; 7 December 2004, 4 hosts with 1, 1, 1, 2, respectively; 7 June 2005, 3 hosts with 1, 2, 2, respectively; 20 May 2006, 4 hosts with 2, 2,

7, 7, respectively; 25 May 2008 3 hosts with 1, 1, 2, respectively;

Site of infection: Intestine.

Type host and type locality: no type host was indicated (BAKER 1980), Germany (ZEDER 1800).

Geographic range: Western Europe (BAKER 1987).

Specimens deposited: Uludag University Museum of Zoology.

Remarks: *Oxysomatium brevicaudatum* has been previously reported from *R. dalmatina* collected in France (BAKER 1980) and Turkey (DÜŞEN *et al.* 2009).

ACANTHOCEPHALA

Echinorhynchidae

Acanthocephalus ranae (Schrank, 1788)

Prevalence, mean intensity and range: 24 infected out of 32 hosts studied (75%, 2.79 ± 1.28 , 1-6).

Temporal distribution: Çınarcık: 11 March 1998, 1 host with 2; 7 December 2004, 4 host with 2, 2, 3, 3, respectively; 7 June 2005, 4 hosts with 2, 2, 3, 3, respectively; 20 May 2006, 5 hosts with 3, 3, 4, 5, 6, respectively; 25 May 2008, 3 hosts with 2, 3, 4, respectively; Çaykara: 11 July 2001, 2 hosts with 1, 2, respectively; 15 July 2002, 1 host with 3; 18 July 2004, 4 hosts with 1, 2, 2, 4, respectively.

Site of infection: Intestine.

Type host and type locality: *Rana esculenta*, Europe (SCHRANK 1788).

Geographic range: Western Europe.

Specimens deposited: Uludag University Museum of Zoology.

Remarks: *Acanthocephalus ranae* has been previously reported in *R. dalmatina* from Denmark (FRANDSEN 1974) and Turkey (DÜŞEN *et al.* 2009).

Discussion

A total of 378 helminths were collected from 31 (97%) of the 32 frogs examined: one Monogenean, 44 Digeneans, 266 Nematodes, and 67 Acanthocephalans. Nine helminth species were present in our survey: five species from hosts collected in Çınarcık (*Polystoma mazurmovici*, *Cosmocerca ornata*, *Oswaldocruzia filiformis*, *Oxysomatium brevicaudatum* and *Acanthocephalus ranae*); seven species from hosts collected in Çaykara (*Gorgoderia cyngoides*, *Pleurogenoides medians*, *Haplometra cylindracea*, *Cosmocerca ornata*, *Oswaldocruzia filiformis*, *Rhabdias bufonis* and *Acanthocephalus ranae*). However, from Çınarcık, no host harboured more than three helminth species (10 [31%] harboured three species, 10 [31%] harboured two spe-

cies, one [3%] harboured one species and in one host [3%] no helminths were found); from Çaykara, no host harboured more than six species nor less than four species (one host [3%] harboured six helminth species, five [16%] harboured five species, four [13%] harboured four species. There were 2.32 ± 0.17 (mean \pm 1 SE) helminth species per infected frog, and 5.09 ± 0.61 helminth individuals per infected frog from Çaykara, and 4.70 ± 0.21 helminth species per infected frog and 26.60 ± 1.69 helminth individuals per infected frog from Çınarcık. For this sample (Çınarcık plus Çaykara), there were 3.06 ± 0.24 helminth species per infected frog and 11.81 ± 1.91 helminth individuals per infected frog. AHO (1990) compiled distributional patterns for anurans and reported the mean (\pm SE) total number of helminth species per host species as 3.54 ± 0.24 (range 0-9). Thus, the infection rate for *R. dalmatina* in general is similar to that recorded for anurans but there may be great variation between localities.

Similarity characteristics of the helminth component community at the two studied localities were compared: The Jaccard coefficient is based upon species presence in a community and ranges from 0 (no species found in both communities) to 1.0 (all species found in both communities); Morisita's index considers the number of species, the number of individuals, as well as the proportion of the total represented by each species and ranges from 0 (no similarity) to 1.0 (identical); percentage of similarity is based upon species abundance and ranges from 0% (no species found in both communities) to 100% (same species found in both communities at similar abundances). We found Jaccard coefficient = 0.33, Morisita's index = 0.41, percentage of similarity = 0.29. The two localities shared three species in common (*C. ornata*, *O. filiformis* and *A. ranae*). We have no explanation for the absence of four species from Çınarcık other than to note that helminth species often exhibit patchy distribution patterns (GOLDBERG *et al.* 2001).

Helminth species have been classified as core and secondary species according to their prevalence (P): species with prevalences >30% are deemed core species and species with 10-30% prevalences are considered secondary species (ROCA 1993). In this sample, *R. bufonis*, *C. ornata*, *O. brevicaudatum*, *A. ranae* and *O. filiformis*, represented core species (P = 31, 38, 47, 75, 81, respectively); *H. cylindracea* represented a secondary species (P = 19). With the exception of *P. mazurmovici*, helminths infecting *R. dalmatina* are generalists and commonly found in European anurans. BURSEY *et al.* (2001) introduced the concept of importance (I), an estimate of the influence of a species within a community calculated

Table 1. Helminth parasites reported from *Rana dalmatina* throughout its geographical range

| Helminth parasites | Locality | Reference | Comment |
|---|----------------|--------------------------------|--------------------------------------|
| MONOGENEA | | | |
| <i>Polystoma integerrimum</i> (Frölich, 1791) | Czechoslovakia | KOZÁK (1973) | |
| <i>Polystoma mazurmovici</i> Buchvarov, 1980 | Bulgaria | BUCHVAROV (1980) | |
| | Turkey | Present study | New geographical record |
| <i>Polystoma</i> sp. | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| DIGENEA | | | |
| <i>Diplodiscus subclavatus</i> (Pallas, 1760) | Bulgaria | BUCHVAROV (1962) | |
| | Czechoslovakia | VOLNA-NABELKOVA (1964) | |
| | Czechoslovakia | KOZÁK (1973) | |
| | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| <i>Gorgodera cygnoides</i> (Zeder, 1800) | Bulgaria | BUCHVAROV (1977) | |
| | Turkey | Present study | |
| <i>Haplometra cylindracea</i> (Zeder, 1800) | Czechoslovakia | PROKOPIC (1957) | |
| | Czechoslovakia | KOZÁK (1973) | |
| | Czechoslovakia | PROKOPIC & KRIVANEC (1975) | |
| | Denmark | FRANSEN (1974) | |
| | Turkey | Present study | |
| <i>Opisthioglyphe ranae</i> (Frölich, 1791) | Bulgaria | BUCHVAROV (1962) | |
| | Czechoslovakia | VOLNA-NABELKOVA (1964) | |
| | Czechoslovakia | KOZÁK (1973) | |
| <i>Pleurogenes claviger</i> (Rudolphi, 1819) | Czechoslovakia | KOZÁK (1973) | |
| | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| <i>Pleurogenoides medians</i> (Olsson, 1876) | Bulgaria | BUCHVAROV (1977) | |
| | Czechoslovakia | KOZÁK (1973) | |
| | Czechoslovakia | PROKOPIC & KRIVANEC (1975) | |
| | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| <i>Tylodelphys rhachiaea</i> (Henle, 1833) | Bulgaria | BUCHVAROV (1962) | larva (avian parasite) |
| CESTODA | | | |
| <i>Nematotaenia dispar</i> (Goeze 1782) | France | JOYEUX & BAER (1936) | Host as <i>Rana agilis</i> |
| | France | JONES (1987) | |
| NEMATODA | | | |
| <i>Aplectana acuminata</i> (Schrank, 1788) | Czechoslovakia | PROKOPIC & KRIVANEC (1975) | |
| <i>Aplectana macintoshii</i> (Stewart, 1914) | Czechoslovakia | VOJTKOVÁ (1976) | As <i>Neorailletnema praeputiale</i> |
| | Denmark | FRANSEN (1974) | As <i>Neyraplectana schneideri</i> |
| <i>Cosmocerca commutata</i> (Diesing, 1851) | Bulgaria | BUCHVAROV <i>et al.</i> (1975) | |
| | Czechoslovakia | KOZÁK (1973) | |
| | Czechoslovakia | VOJTKOVÁ (1976) | |
| | Macedonia | HRISTOVSKI (1973) | |
| <i>Cosmocerca ornata</i> (Dujardin, 1845) | Bulgaria | BUCHVAROV (1962) | |
| | Bulgaria | BUCHVAROV (1965) | |
| | Czechoslovakia | PROKOPIC (1957) | |
| | Czechoslovakia | VOLNA-NABELKOVA (1964) | |
| | Czechoslovakia | KOZÁK (1969, 1973) | |
| | Czechoslovakia | MORAVEC & VOJTKOVÁ (1974) | |
| | Czechoslovakia | PROKOPIC & KRIVANEC (1975) | |

Table 1. Continued

| Helminth parasites | Locality | Reference | Comment |
|--|----------------|--------------------------------|---|
| | Czechoslovakia | VOJTKOVÁ (1976) | |
| | Denmark | FRANSEN (1974) | |
| | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| | Turkey | Present study | |
| <i>Oswaldocruzia filiformis</i> (Goeze, 1782) | Bulgaria | BUCHVAROV (1962) | |
| | Bulgaria | BUCHVAROV <i>et al.</i> (1975) | |
| | Bulgaria | KIRIN & BUCHVAROV (2002) | |
| | Czechoslovakia | PROKOPIC (1957) | Host as <i>Rana agilis</i> |
| | Czechoslovakia | Volna-Nabelkova (1964) | |
| | Czechoslovakia | KOZÁK (1969, 1973) | As <i>Oswaldocruzia bialata</i> |
| | Czechoslovakia | PROKOPIC & KRIVANEC (1975) | |
| | Czechoslovakia | VOJTKOVÁ (1976) | |
| | Czechoslovakia | MORAVEC & SCHOLZ (1991) | |
| | Denmark | FRANSEN (1974) | |
| | Yugoslavia | ROZMAN (1976) | As <i>Oswaldocruzia goezei</i> ; host as <i>Rana agilis</i> |
| | Turkey | Present study | |
| <i>Oxysomatium brevicaudatum</i> (Zeder, 1800) | France | BAKER (1980) | |
| | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| | Turkey | Present study | |
| <i>Rhabdias bufonis</i> (Schrank, 1788) | Bulgaria | BUCHVAROV (1962) | |
| | Czechoslovakia | Volna-Nabelkova (1964) | |
| | Czechoslovakia | KOZÁK (1969, 1973) | |
| | Czechoslovakia | PROKOPIC & KRIVANEC (1975) | |
| | Czechoslovakia | VOJTKOVÁ (1976) | |
| | Denmark | FRANSEN (1974) | |
| | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| | Turkey | Present study | |
| ACANTHOCEPHALA | | | |
| <i>Acanthocephalus ranae</i> (Schrank, 1788) | Denmark | FRANSEN (1974) | |
| | Turkey | DÜŞEN <i>et al.</i> (2009) | |
| | Turkey | Present study | |

as I = relative prevalence + relative abundance X 100. By this measure, the most important helminth was *O. filiformis* (I = 64) followed by *A. ranae* (I = 42), *C. ornata* (I = 24), *O. brevicaudatum* (I = 24) and *R. bufonis* (I = 22).

A parasite list is provided in Table 1. Monogeneans are generally considered to infect the host directly (SMYTH 1994). Digeneans usually require a molluscan intermediate host and infection may occur by ingesting the molluscan host or encysted metacercariae from the environment or within a prey item (SMYTH & SMYTH 1980). JOYEUX (1927) considered *Nematotaenia dispar* to have a direct life cycle with infection occurring through ingestion of Cestode eggs. The Nematodes found in this study

infect either orally or by skin penetration (ANDERSON 2000). Acanthocephalans require an arthropod intermediate host (SCHMIDT 1985). Thus, both diet and exposure to contaminated substrate contribute to the helminth infections found in *Rana dalmatina*.

As a result of this study, the agile frog *Rana dalmatina* was examined for helminth parasites from Turkey. There were some studies related to this host species from different localities and countries. We registered new localities for all of the helminth species that were recorded from *Rana dalmatina* in the course of the present study. Turkey is a new geographical record for *Haplometra cylindracea*. A checklist of helminth parasites recorded from *Rana dalmatina* throughout its geographical range is presented.

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