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Research Note

Endoparasites of the Bridled Mabuya, *Heremites vittatus* (Olivier, 1804) (Squamata: Scincidae) from Türkiye

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ABSTRACT: Ninety-five bridled mabuya, *Heremites vittatus* (37 males, 49 females, and 9 juveniles) collected throughout Türkiye were examined for helminths. One species of trematode, *Plagiorchis elegans*; 1 species of cestode, *Mesocestoides* sp.; and 5 species of nematode, *Parapharyngodon* sp., *Skrjabinodon pigmentatus, Spauligodon aloisei, Spauligodon eremiasi,* and *Thubunaea* sp. were found. One new locality record and 7 new host records are reported.

KEY WORDS: Digenea, Cestoda, Nematoda, Lizard.

Heremites vittatus are thin and up to 20 cm long. Scales are clearly carinated. The lower eyelid has a central and transparent disc. The nostril is located in the nasal plate. It is common in the Middle, South, and the Southern Anatolia regions of Türkiye, North Africa, and countries east of the Mediterranean. It lives in forests, open fields, and gardens (Budak and Göçmen 2008). We know of no reports of helminths from *H. vittatus* and in this note, we establish an initial helminth list for *H. vittatus*.

We examined 95 individuals of *H. vittatus* (37 males, 49 females, and 9 juveniles) collected during March–August between 1991 and 2018 from various locations in Türkiye. The lizards were killed with an overdose of sodium pentobarbital. The body cavity was opened with a longitudinal incision with a scalpel blade, and the digestive tract removed. The esophagus, stomach, small and large intestines, and lungs were opened and separately examined for helminths under a dissecting microscope. Nematodes were fixed in 70% ethanol and mounted on glass slides in glycerol. Trematodes and cestodes were fixed in 70% ethanol, stained with iron-carmine as described by Georgiev et al. (1986), cleared in clove oil, and mounted in Entellan. Nematodes were identified to genus using the keys in Anderson et al. (2009) and Gibbons (2010), and to species by comparisons with the original descriptions. Trematodes and cestodes were identified using Schmidt (1986). Helminth voucher specimens were deposited in the helminth collection of Uludağ University Museum of Zoology, Bursa, Türkiye (BUUZM-HELM-2021, 1–7). Lizard specimens were deposited in the Department of Biology, Adıyaman University, Adıyaman, Türkiye.

Found were 1 species of trematode: *Plagiorchis elegans*; 1 species of cestode: *Mesocestoides* sp. (as tetrathyridia); and 5 species of nematodes: *Parapharyngodon* sp., *Skrjabinodon pigmentatus, Spauligodon eremiasi, Spauligodon aloisei, Thubunaea* sp. Various infection descriptions were calculated by Bush et al. (1997) and the site of infection, number of helminths, prevalence, mean intensity, abundance, and range of infection are given in Table 1.

Of the identified species, *P. elegans*, *S. aloisei* and *S. eremiasi* have been previously reported from Türkiye. *Plagiorchis elegans* was first reported from Türkiye in the Balkan green lizard, *Lacerta trilineata*, by Yıldırımhan et al. (2011) and later in the Common wall lizard, *Podarcis muralis*, by Yıldırımhan and Sümer (2019), as well as the mediterranean chameleon, *Chameleo chamaeleon* by Birlik et al. (2020). The distribution range of this parasite covers the northern hemisphere (Yıldırımhan et al., 2011). *Heremites vittatus* represents a new host record for *P. elegans*. *Spauligodon aloisei* was described from specimens collected from the Italian wall lizard, *Podarcis siculus* by Casanova et al. (2003) and first reported in Türkiye from the Brandt's Persian lizard, *Iranolacerta brandtii*, by Birlik et al. (2017).

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Table 1. Site of infection, number of helminths, prevalence, mean intensity, abundance, and range of infection for 7 endoparasitic species in *Heremites vittatus* from Türkiye.

Helminth	Site of infection	Number	Prevalence	Mean intensity	Abundance	Range
Plagiorchis elegans	Small intestine	14	3/95 (3.15%)	4.6	0.14	0–11
Mesocestoides sp. (tetrathyridia)	Body cavity	3	1/95 (1.05%)	3	0.03	0–3
Parapharyngodon sp.*	Large intestine	1	1/95 (1.05%)	1	0.01	0–1
Skrjainodon pigmentatus	Large intestine	46	2/95 (2.10%)	23	0.48	0–32
Spauligodon aloisei	Large intestine	6	2/95 (2.10%)	3	0.06	0-4
Spauligodon eremiasi	Large intestine	48	4/95 (4.20%)	12	0.50	0–36
Thubunaea sp.	Stomach	10	1/95 (1.05%)	10	0.10	0–10

* Female only.

Heremites vittatus represents a new host record for *S. aloisei*. *Spauligodon eremiasi* was first reported in Türkiye by Düşen et al. (2013) in the Strauch's racerunner, *Eremiasi strauchi*, and the suphan racerunner, *E. suphani* and later reported in the golden grass skink, *Heremites auratus*, by Yıldırımhan et al. (2021). *Heremites vittatus* represents a new host record for *S. eremiasi.* Other amphibian and reptile species that have been reported to have been infected by *Plagiorchis elegans*, *Spauligodon aloisei,* and *Spauligodon eremiasi* are detailed in Table 2.

Fourteen individuals could only be assigned to a genus: *Mesocestoides*, *Parapharyngodon*, and *Thubunaea*. A gravid individual is required for assignment to

Table 2. Previous reports of *Plagiorchis elegans*, *Spauligodon aloisei*, and *Spauligodon eremiasi* in different hosts from the world.

Helminths	Hosts	Locality	Citation
Plagiorchis elegans	Balkan green lizard, *Lacerta trilineata*	Türkiye	Yıldırımhan et al. (2011)
	Common wall lizard, *Podarcis muralis*	Türkiye	Yıldırımhan and Sümer (2019)
	Mediterranean chameleon, *Chameleo chamaeleon*	Türkiye	Birlik et al. (2020)
	Yellowbelly toad, *Bombina variegate*	Czechoslovakia	Prokopıc and Krıvanec (1975)
	Pool frog, *Pelophylax lessonae*	Czechoslovakia	Prokopıc and Krıvanec (1975)
	Common frog, *Rana temporaria*	Romania	Capuse (1971)
	Sand lizard, *Lacerta agilis*	Romania, Belarus, Palaearctic, and Moravia	Shevechenko and Barabashova (1958); Moravec (1963); Capuse (1971); Lewın (1992a); Shımalov et al. (2000); Sharpılo et al. (2001)
	European green lizard, *Lacerta viridis*	Romania	Capuse (1971)
	Viviparous lizard, *Zootoca vivipara*	Poland	Lewın (1992b); Shımalov et al. (2000)
	European grass snake, *Natrix natrix*	Belarus, Romania	Capuse (1971)
Spauligodon aloisei	Italian wall lizard, *Podarcis siculus*	Italy	Casanova et al. (2003)
	Brandt's persian lizard, *Iranolacerta brandtii*	Türkiye	Birlik et al. (2017)
	Spiny tailed lizard, *Darevskia rudis*	Türkiye	Birlik et al. (2018a)
	Valentin's lizard, *Darevskia valaentini*	Türkiye	Birlik et al. (2018b)
Spauligodon eremiasi	Strauch's racerunner, *Eremias strauchi*	Türkiye	Düşen et al. (2013)
	Suphan racerunner, *Eremias suphani*	Türkiye	Düşen et al. (2013)
	Golden grass skink, *Heremites auratus*	Türkiye	Yıldırımhan et al. (2021)
	Arguta racerunner, *Eremias argute*	Asia, Volga	Markov and Bogdanov (1961); Markov et al. (1962)
	Kirghiz racerunner, *Eremias nikolskii*	Asia, Volga	Markov and Bogdanov (1961); Markov et al. (1962)
	Pleske's racerunner, *Eremias pleskei*	Volga	Markov et al. (1962)
	Regel's racerunner, *Eremias regeli*	Volga	Markov et al. (1962)
	Stauch's racerunner, *Eremias strauchi*	Volga	Markov et al. (1962)
	Central asian racerunner, *Eremias velox*	Asia, Volga, Azerbaijan, Georgia	Markov and Bogdanov (1961); Markov et al. (1962); Uhlirova, (2005); Murvanidze et al. (2008)
	Meadow viper, *Vipera ursinii*	Volga	Bakiyev and Kirillov (2007)

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Mesocestoides, only tetrathyridia were collected in this study; assignment to *Parapharyngodon* and *Thubunaea* is based on male characters; only female individuals were found.

The life cycle of *Mesocestoides* sp. is unknown but is thought to utilize 3 hosts, a vertebrate definitive host, a vertebrate second intermediate host, and an arthropod first intermediate host (McAllister et al., 2014). Tetrathyridia are commonly found in the body cavities of amphibians, reptiles, and rodents (Padgett and Boyce, 2004). A summary of hosts will be found in Bursey et al. (2012). *Heremites vittatus* represents a new host record for tetrathyridia of *Mesocestoides* sp.

Several species of *Parapharyngodon* have been reported from Türkiye including *P. bulbosus, P dogieli, P. kasauli, P. lilfordi, P. psammodromi,* and *P. tyche*. Incedogan et al. (2014) reported the ocellated skink, *Chalcides ocellatus* to harbor *P. bulbosus* and Yıldırımhan et al. (2021) found *P. dogieli*, *P. lilfordi*, and *P. psammodromi* in *Heremites auratus.* Yıldırımhan et al. (2006) reported *P. kasaluli* and *P. tyche* in the Roughtail rock agama, *Laudakia stellio* but only *P. tyche* in the caucasian agama, *Paralaudaia caucasia* (reported as *Laudakia caucasia*). *Heremites vittatus* represents a new host record for *Parapharyngodon*.

To our knowledge, no species of *Thubunaea* has been reported from Türkiye. It should be noted that 4 species are known from the Palaearctic biogeographical region, namely, *T. baylisi*, *T. dessetae*, *T. schukurovi*, and *T. smogorzhewekii* (Baker, 1987). Birlik et al. (2016) did report *Phoenicolacerta laevis* to host individuals they identified only to the genus level, *Thubunaea. Heremites vittatus* represents a new host record for the genus *Thubunaea.*

Skrjabinodon pigmentatus (previously, *Parathelandros pigmentatus*) was originally described from *Eremias multiocellata* collected in Central Asian USSR by Markov and Bogdanov (1961) but reassigned by Barus and Coy Otero (1974). It was also reported from *Laudakia caucasia* (currently, *Paralaudakia caucasia*) collected in Iran (Rezazadeh et al., 2012). *Heremites vittatus* represents a new host record for *Skrjabinodon pigmentatus* and Türkiye is a new location record.

Except for *P. elegans*, *Mesocestoides* sp., and *Thubunaea* sp., the helminths infecting *H. vittatus* are monoxenous. Because no secondary host is required by these helminths, habitat, not diet, is the important factor for infection. Likewise, the helminths infecting *H. vittatus* are generalists, helminths that infect many of the lizard species found in Türkiye. Examination of additional species of Turkish lizards will most likely find a pattern of infection as reported here: monoxenous generalists.

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