Gastrointestinal helminths of the Caspian turtle, *Mauremys caspica* (Testudines), from Northern Iran

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Abstract The Caspian turtle (*Mauremys caspica*) is a semi-aquatic and adaptable reptile. To date, there are no reports on the parasites of this turtle in Iran. Hence, the current survey was designed to prepare a list of the gastrointestinal helminth parasites of the Caspian turtle in North Iran. A total of 34 road-killed individuals (14 males and 20 females) were collected between July 2011 and October 2012 from the Mazandaran province, Iran. All parts of gastrointestinal were parasitologically scrutinized and collected specimens were fixed and preserved in 70 % ethanol. Half of the examined Caspian turtles (17) were infected with at least one parasitic helminth. The list of helminths includes three nematodes: *Serpinema microcephalum* (Camallanidae), *Falcaustra armenica* (Kathliniidae), *Oxyuridae* sp., and one digenean: *Telorchis* sp.

(Telorchidae). This is the first report of the gastrointestinal helminth parasites of the Caspian turtle in Iran and all helminth species are reported for the first time in Iran.

Keywords Helminth · Parasite · Caspian turtle · Reptile · *Mauremys caspica* · Iran

Introduction

Even though various species of reptiles are abundant in the Iranian ecosystems they have received little attention by parasitologists and biologists regarding their parasites and host–parasite interactions. One of these reptiles is the Caspian turtle or striped-neck terrapin *Mauremys caspica* (Gmelin, 1774), which belongs to the family Geoemydidae. It has a broad natural range from Spain, Eastern Europe, to Turkey, Iran, Saudi Arabia, Bahrain, Lebanon and other Middle Eastern countries (Fritz and Freytag 1993).

This semi-aquatic turtle is tan to blackish in color and medium size (25 cm). They are generally observed in fresh and brackish waters, with temperatures around 10 °C and pH as high as 8.0, and fairly tolerant to environmental pollution. Its carapace is low, oval and it has slight medial keel. Females are recognized by their larger body, flat plastrum and shorter tail with the vent under the rim of the carapace, whereas males are smaller with concave plastrum and longer tail with the vent beyond the rim of the carapace. Females usually lay clutches of 4–6 eggs (Barth et al. 2004). Recently, turtles are receiving a great attention and becoming increasingly popular, because they are considered as exotic pet, particularly small terrestrial and freshwater ones. Moreover, their plastrons are widely used in traditional Chinese medicine (Chen et al. 2009) and the meat is considered delicacy in a number of cultures.

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Recently, turtle farm is established to raise turtles for their meat (Roman and Brian 2000).

Since there is no published work on the helminth fauna of the Caspian turtle in Iran, the main goal of the current investigation was to list of the gastrointestinal parasitic helminths of this turtle in North Iran.

Materials and methods

Sampling

A total 34 road-killed Caspian turtles (14 males and 20 females, weight 280–720 g) were collected from rural areas of the Mazandaran province, Iran, from July 2011 to October 2012. The turtles were transported to the Laboratory of Veterinary Diagnostic Medicine at the Islamic Azad University, Babol- Branch for examination.

To look for endoparasites, each digestive tract (Esophagus, Stomach, Small intestine and Large intestine) was opened up along its entire length. After collecting the visible helminths, contents were rinsed into sieve mesh 70 to collect the remaining helminths. Digenea were fixed and preserved in 70 % ethanol, stained with Carmin acid, dehydrated, then cleared and mounted in Canada-balsam. Nematodes were killed in hot saline solution and kept in a solution composed 70 % ethanol and 5 % glycerin, for examination they were cleared by lactophenol. Identifications were performed

using specialized literature (Anderson et al. 1974; Bray et al. 2008). Specimens have been deposited in the Helminthological Collection of the Institute of Parasitology, Biology Center of the Academy of Sciences of the Czech Republic.

Study area

Mazandaran province (36°33'56"N, 53°03'32"E) is located at the northern part of Iran and on the southern coast of the Caspian Sea. It covers an area of 23,842 km², its population is composed by 2,922,432 inhabitants and has a moderate, subtropical climate with an average temperature of 25 °C in summer and 8 °C in winter. This province is geographically divided into the coastal plains and the mountainous areas of Alborz Mountains Range. It has diverse ecosystems including many plains, prairies and forests (Borhani et al. 2010) (Fig. 1).

Results

From 34 examined Caspian turtles, 50 % (17) harbored at least one helminth. Eleven turtles had 1 species, one was parasitized by two, and two turtles had three helminth species. The following four helminths were obtained, three nematodes: *Serpinema microcephalum* (Dujardin, 1845) (Accession number N-133) (Figs. 2, 3) *Falcaustra*

Fig. 1 Map of Iran, Western Asia, green area shows position of Mazandaran province

Fig. 2 Head of *S. microcephalum* obtained from Caspian turtle small intestine

Fig. 4 Head of *F. armenica* obtained from Caspian turtle large intestine

Fig. 3 Tail of *S. microcephalum* obtained from Caspian turtle small intestine

Fig. 5 Tail of *F. armenica* obtained from Caspian turtle large intestine

armenica Massino, 1924 (Figs. 4, 5), *Oxyuridae* sp., and one digenean: *Telorchis* sp.. The nematodes *S. microcephalum* and *F. armenica* were the most prevalent species, while the two remaining were rare. A significant variation in the infection rate was observed between host sex, females had higher prevalence than males (35.2 vs. 14.7 %) (Table 1). All helminths were recovered from small and large intestine of *M. caspica*.

Discussion

In similar investigation on the helminth fauna of 45 Eastern Caspian turtles (*M. c. caspica*) in Iraq, 66.6 % of examined turtles were parasitized with *S. microcephalum* and 39.9 % harbored *T. stunkardi*. In addition, *F. japonensis* was collected from small intestine of five Euphrates soft-shelled turtle *Trionyx euphraticus* (Al-Barwari and Saeed 2007). In addition, *T. Stunkardi* was obtained from a large male *Amphiuma means* in Louisiana (Chandler 1973). In one

study in Turkey on twelve European pond turtles, *Emys orbicularis*, four helminth species were found *Patagium lazarewi* (Digenea), *S. microcephalum*, *F. armenica* and *Spiroxys* sp. (Yildirimhan and Sahin 2005). The following parasites were collected from *Clemmys caspica* var. *leprosa* and *Emys orbicularis* in Tunisia: *Polystomoides tunisiensis*, *T. temimi*, *T. solivagus*, *Camallanus parvus*, *Spiroxys contortus* and *S. lambdiensis contortus* (Mishra and González 1978). Although in a survey on western painted turtle, *Chrysemys picta belli*, seven species were reported (Platt 2000), but none of them was found in our study.

An investigation was carried out on 40 eastern box turtles (*Terrapene carolina carolina*) from southern Indiana, USA. The following parasites were recovered: two digenean trematodes (*T. robustus* and *Brachycoelium salamandrae*) and five nematodes (*Oswaldocruzia pipiens*, *Cosmocercoides dukae*, *F. affinis*, *F. chelydrae* and *S. trispinosus*) (Moraga et al. 2012).

Although none of the examined turtles showed evident pathological signs, the nematode *S. microcephalum* has

Table 1 Infection parameters of the gastrointestinal helminths from *M. caspica* ($n = 34$) in North Iran

Helminth	Site of infection	Prevalence (%)	Prevalence per sex (%)	
			♂ ($n = 14$)	♀ ($n = 20$)
Trematoda (adult)				
<i>Telorchis</i> sp.	Small intestine	1/14	2.9	0
Nematoda (adults)				
<i>Serpinema microcephalum</i>	Small intestine	♂ (3/14) and ♀ (8/20)	21.4	40
<i>Falcaustra armenica</i> Larva	Ileum, caecum, colon	♂ (3/14) and ♀ (4/20)	21.4	20
<i>Oxyuridae</i> gen. sp.	Large intestine	1/20	0	2.9

been associated with pancreatitis in exotic red-eared slider turtles (*Trachemys scripta elegans*) in southern Spain (Hidalgo-Vila et al. 2011). Yildirimhan et al. (2011) observed *F. armenica* in Balkan green lizard Bursa in Turkey.

Even though we found no zoonotic helminths in our study, it is well known that nowadays pets have a significant role in terms of transmitting causative agents of diseases to human worldwide. They are considered as an important companion in many households, contributing in activities such as physical, emotional and social development of children and the well-being of their owners. Despite of this fact potential danger associated with pet ownership should not be neglected. Exotic animals are remarkably being invited into homes as pets. Nonetheless, neither pet owners nor veterinary healthcare providers are enough acquainted with the importance of many of these animals in the transference of diseases.

Therefore, pet owners are more at risk of zoonotic diseases due to close contact with exotic animals, which can transmit parasites, such as *Aeromonas hydrophila*, *Clostridium* sp., and *Salmonella* spp. (Hidalgo-Vila et al. 2007).

Thus, further precise helminthological surveys are required in Iran to expand our knowledge concerning helminthic parasites of Caspian turtle and their probable zoonotic and veterinary diseases. In conclusion, this is the first survey on the gastrointestinal helminth parasites of *M. caspica* in Iran and all helminthes represent new geographical records.

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