On the Helminth Fauna of Some Iraqi Reptiles

Shlemon E. AL-BARWARI[1], Isam SAEED[2]

[1]Salahaddin University, Biology Division, Medical College, Erbil, Iraq, [2]University of Copenhagen Faculty of Life sciences, Institut for Veterinary Pathobiology, DK-1870 Frederiksberg C, Danimarka

SUMMARY: A study on the parasitofauna of 7 species of Iraqi reptiles revealed the presence of at least 8 adult helminth species and some tentatively identified larvae. The reptiles were *Hemidactylus flaviviridis, H. persicus, Asaccus elisae, Spalerosophis d. cliffordi, Testudo g. terrestris, Mauremys c. caspica* and *Trionyx euphraticus*. The helminths found comprised 1 species of digenetic trematodes (*Telorchis stunkardi*), cysticercoids of *Diplopylidium nolleri* and 7 nematode species (*Thelandros* sp., *Microtetrameres* sp., *Angusti-caecum holopterum, Atractis dactyluris, Tachygonetria nicolleri, Camallanus microcephalus*, and *Falcaustra japonensis*). Information about the locality of collection, infection site and rate and parasite burden is provided. Although similar cysticercoid larvae and adults of *Thelandros* sp. and *Microtetrameres* sp. were previously recorded from Iraq, the scope of the relevant data is considerably extended. In the researchers' judgment, the rest of the parasite species represents a new addition to the Iraq list.

Key words: Turtle, Lizard, Snake, Helminth, Iraq

Irak'ın Bazı Reptillerinin Helmint Faunası

ÖZET: Bu çalışmada, Irak'ın 15 farklı bölgesindeki 7 sürüngen türü, helmintler yönünden incelenmiştir. Çalışmanın sonucunda, kaplumbağalardan 6, Kertenkelelerden 3, Yılanlardan 1 tür olmak üzere toplam 9 farklı tür helmint tespit edilmiştir. Bu helmint türlerin-den altısı Irak'tan ilk kez bildirilmiştir. Bu çalışmada, Irak'daki reptılelerin parazit faunasında en az 8 ergin helmint türü ve muhtemel larvalarının olduğu bildirilmiştir. İncelenen reptil türleri *Hemidactylus flaviviridis, H. persicus, Asaccus elisae, Spalerosophis d. cliffordi, Testudo g. terrestris, Mauremys c. caspica* ve *Trionyx euphraticus*'dir. Bir tür digenik trematod (Telorchis stunkardi), Diplopylidium nolleri'nin sistiserkoidi ve 7 tür nematod (*Thelandros* sp., *Microtetrameres* sp., *Angusticaecum holopterum, Atractis dactyluris, Tachygonetria nicolleri, Camallanus microcephalus*, ve *Falcaustra japonensis*) bildirilmiştir. Parazitlerin Irak'ın hangi bölgelerinde bulun-duğu ve konakçıda yerleştiği yere göre, dağılımları bildirilmiştir. Benzer sistiserkoid larvaları ve *Thelandros* sp. ve *Microtetrameres* sp. erginleri daha önce Iraktan'tan bildirilmiştir. Diğer türler ise Irak'tan ilk kez bildirilmiştir.

Anahtar Sözcükler: Kaplumbağa, Kertenkele, Yılan, Helmint, Irak.

INTRODUCTION

Many species of reptiles are prevalent in the Iraqi ecosystems. They comprise such principal categories like lizards, snakes, tortoises and turtles. However, very little attention has been paid by Iraqi and non-Iraqi biologists to the parasitism in any group of them. To date as far as it is discernible from the review of the literature, only few species of lizards and snakes have been examined for this purpose (2, 14, 17, 20, 23, 26). Then altogether only a species of blood Protozoa, 4 species of adult helminthic parasites (2 Nematoda and 2 Cestoda) and few cysticercoid larvae are hitherto recovered from these animals. Therefore, the paucity of data relevant to this field of Iraqi parasitology is obvious.

By virtue of constituting a major group of vertebrates, researches on reptiles and their parasitic communities in any part of the world are important to pure and applied sciences in many different ways (5, 6, 11). They are bound to improve the knowledge about their diseases and zoonoses as well as that pertinent to the biodiversity and bionomics of different populations involved in these types of associations. Hence, for example, they may provide invaluable evidences to such significant and interrelated issues like the patterns of natural selection of various parasites towards their hosts and host-parasite relationships, assemblages and adaptations of life cycles including epidemiology of infective stages and competitive processes between species parasitizing the same hosts.

A helminthological research of 7 species of reptiles, collected from different localities within Iraq, was carried out. Four of these reptiles are examined for the first time from this country.

Several species of parasites were either definitely or tentatively identified, among which were new national records as well as new host and locality records. The implications of these findings are appraised and discussed. Moreover, the researchers regard this study as an additional means of encouragement to investigate specifically the parasitofauna of Iraqi reptiles.

MATERIALS AND METHODS

The samples of hosts examined in this study represent 5 important families of the Iraqi reptiles, namely, Gekkonidae, Colubridae, Testudinidae, Bataguridae and Trionychidae. They made a total number of 365 individuals, divided as following: 134 yellow-bellied house geckos *Hemidactylus flaviviridis* (Ruppell, 1835); 69 Persian geckos *H. persicus* (Anderson, 1872); 85 leaf-toed geckos *Asaccus* (= *Phyllodactylus*) *elisae* (F. Werner, 1895), 5 diadem snakes *Spalerosophis diadema cliffordi* (Schlegel, 1837), 22 common Mediterranean spur-thighed tortoise *Testudo graeca terrestris* (Forskall, 1775); 45 Eastern Caspian turtle *Mauremys caspica caspica* (Gmelin, 1774); and 5 Euphrates soft-shelled turtle *Trionyx* (= *Rafetus*) *euphraticus* (Daudin, 1802).

Reptiles were at their adult stage and selection of specimens of the two sexes was at random. They were collected from different localities of Iraq (Fig. 1) during 1985-1992. Euthanasia was often carried out with chloroform and dissection took place as soon as possible afterwards. Body cavity and different organs were examined, with a special attention being paid to the alimentary canal due to a prospect of helminth existence. The main anatomical regions of the latter organ were separated from each other, individually cut open and their contents emptied into Petri-dishes or suitable receptacles containing physiological saline. The containers were inspected closely for the presence of helminths both with a magnifying lens and a dissecting microscope.

Collection and temporary and permanent preparations of the helminths were made according to the standard methodologies for trematodes, cestodes and nematodes. Illustrations, morphological descriptions and diagnostic keys of Baker (6), Skrjabin (28) and Anderson (5) aid in the analysis of the distinctive characters and ultimately in the identification of most of the parasitic forms encountered. Furthermore, whenever necessary, duplicate of the specimens were sent to experts on parasite systematics in order to confirm their identification.

Determination of the parasitization level was carried out in accordance with the concept that by the "infection rate" is meant the prevalence of a parasite among its host's sample as a whole, while the "parasite burden" is the infection intensity or average load of the parasite members in the infected cases only.
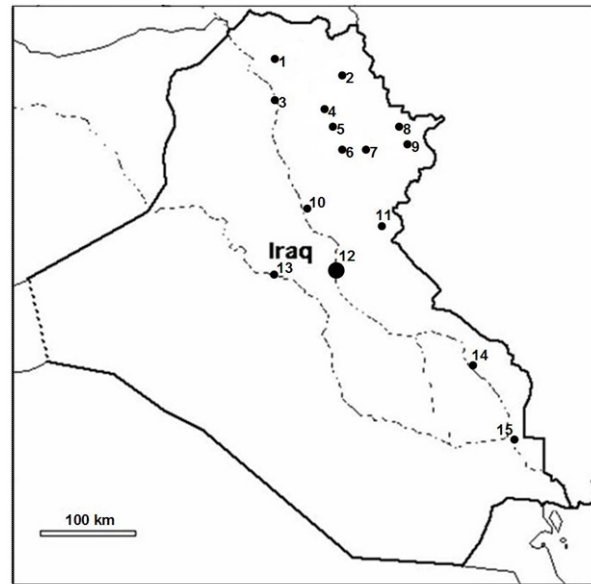

Figure 1: A map of Iraq indicating the localities from which samples of reptiles were collected: 1. Dohuk, 2. Hareer, 3. Mosul, 4. Erbil, 5. Alton-Kopri, 6. Kirkuk, 7. Rabia'a, 8. Mawat, 9. Sar-Jinar, 10. Samarra, 11. Diyala, 12. Baghdad, 13. Ramadi, 14. Maysan, and 15. Basrah.

RESULTS

Nine species of helminthic parasites were encountered in the specimens of reptiles examined in this study. They comprised 1 trematode, 1 cestode and 7 nematodes. These parasites belong to 9 families.

A summarized account on these parasites and their hosts is presented in Tab. 1; including their names, collection localities, infection sites and rates, and parasite burdens. The global infection rate was about 73%, with no significant overall sex variation. No adult cestodes and adult or larval acanthocephalans were encountered during the course of this study.

Out of the samples of 3 species of geckkonid lizards examined, as well as the male specimen of the diadem snake, there were specimens harbouring on their coelomic peritoneal membranes some cyclophyllidean neotenic growths or lacunal metacestodes of *Diplopylidium nolleri* (Skrjabin, 1924). These objects appeared to be attached to the host's tissues by pedicel-like structures and showed histological characteristics of the cysticercoids. Therefore, they represent a larval stage, which means that they are not qualified to complete their life cycles in the reptilian hosts from which they were recovered. The level of parasitization, whether in terms of infection rate or parasite burden, in *A. elisae* was constantly higher than in the 2 other species of geckos. The figures on the sex variation may look significantly different, but upon averaging the data for the 3 lizard species, only a slight variation, if of any suggestive intrinsic influence, is apparent. On the other hand, the infected specimen of the snake was male.

Table 1. Parasitic species found in specimens of 7 Iraqi reptile species examined in this study.

Host species (no of examined)	Locality	Parasite species	Infection site(s)	Infection Rate (%)		Mean Intensity	
				Male	Female	Male	Female
H. flaviviridis (n=134) Male: 67 Female: 67	Baghdad, Diyala, Samarra	*Diplopydium nolleri*	Peritoneum	7.5	9.0	29.0	33.7
	Ramadi, Maysan, Basrah,	*Thelandros* sp	Rectum, S.intestine	17.9	20.9	11.4	7.5
	Kirkuk, Erbil, Dohuk	*Microtetrameres* sp.	Stomach	1.5	4.4	1.0	2.0
H. persicus (n=69) Male: 34 Female: 35	Baghdad, Diyala, Samarra,	*Diplopydium nolleri*	Peritoneum	5.9	11.4	30.5	23.5
	Ramadi, Maysan, Kirkuk	*Thelandros* sp.	Rectum, S.intestine	14.7	5.7	4.7	6.0
A. elisae (n=85) Male: 42 Female: 43	Mousul, Erbil, Kirkuk	*Diplopydium nolleri*	Peritoneum	11.9	9.3	41.2	36.0
		Thelandros sp.	Rectum, S.intestine	50.0	34.9	32.8	29.3
S. d. cliffordi (n=5) Male: 3 Female: 2	Kirkuk	*Diplopydium nolleri*	Peritoneum	33.3	0.0	23.0	0.0
T. g. terrestis (n=22) Male: 11 Female: 11	Mawat, Rabia'a	*Angusticaecum holopterum*	S. intestine, stomach	27.3	36.4	12.3	6.0
		Atractis dactyluris	S. intestine, stomach	54.5	63.6	90.8	87.1
		Tachygonetria nicolleri	Rectum	54.5	45.5	89.2	76.8
M. c. caspica (n=45) Male: 22 Female: 23	Hareer, Sar-Jinar	*Camallanus microcephalus*	S. intestine	31.8	34.8	67.9	63.8
	Alton-Kopri, Rabia'a	*Telorchis stunkardi*	S. intestine	18.2	21.7	41.8	32.0
T. euphraticus (n=5) Male: 3 Female: 2	Alton-Kopri	*Falcaustra japonensis*	S. intestine	66.7	50.0	7.0	6.5

Amongst the nematode forms encountered, 2 of them were reserved at the generic category. The rest of the parasite forms were definitely identified.

Both of the nematodes that were not completely identified were found in geckos. The first of them belongs to the genus *Thelandros* (Wedl, 1862) (Oxyurida: Oxyuridae), for which *A. elisae* is thought to represent a new host record. The highest parasitization level with this parasite was found to be in *A. elisae* and the average figures indicate that males of these geckos serve slightly better hosts than their females for the forenamed species of intestinal nematodes. The second nematode belongs to the genus *Microtetrameres* (Travassos,

1915) (Oxyurida: Tetrameridae). This observation involves a new host record whose infection nature will constitute a subject of appraisement in discussion.

One species of trematode and 5 species of nematodes were recovered from the alimentary canals of 72 specimens of tortoises and turtles inspected. These were identified as: *Angusticaecum holopterum* (Rudolphi, 1819) and *Atractis dactyluris* (Rudolphi, 1819) both of family Atractidae (Ascarida), and *Tachygonetria nicolleri* of family Pharyngodonidae (Oxyuroidea), from the Mediterranean spur-thighed tortoise *T. g. terrestris*; *Camallanus microcephalus* (Dujardin, 1845) of family Camallanidae (Spiruroidea) and

Telorchis stunkardi of family Telorchiidae (Digenea) from Eastern Caspian turtle *M. c. caspica*; and *Falcaustra* (=*Spironoura*) *japonensis* (Yamaguti, 1935) of family Kathlaniidae (Cosmocercoidea) from Euphrates soft-shelled turtle *T. euphraticus*.

Telorchis stunkardi (Chandler, 1923) was the only trematode species found in this study. The Eastern Caspian turtles that were recovered from were collected from 4 different localities in 3 Provinces (Kirkuk, Erbil and Sulaimania) of northern region of Iraq. The infection rate seems to be slightly higher in the sample of females than males, while the parasite burden is considerably higher among infected males than females.

The infection rates and parasite burdens of the above mentioned nematodes of a tortoise and turtles were variable (Tab. 1). The highest and lowest infection rates were for *F. joponensis* in males of *T. euphraticus* and *C. microcephalus* in males of *M. c. caspica*, respectively; whereas, the highest and lowest parasite burdens were for *A. dactyluris* among the infected males of *T. g. terrestris* and *A. holopterum* among the infected females of the same host, respectively. The outcome of averaging all the relevant data to these gastrointestinal nematodes would suggest an overall infection rate of about 46%, with only slightly higher parasitization indices for male than female chelonian hosts.

DISCUSSION

The same number of helminthic species was obtained for male and female specimens of reptiles studied. Moreover, no significant variation in the infection rate or parasite burden was generally noticed in accordance with the sex of the host. This indicates that whatever influences the reptilian sex hormones exert on their helminthic parasites, they are not profoundly reflected on the levels of parasitization.

Failure to encounter any infection with adult cestodes and acanthocephalans in the material of the study may be due to some barriers of phylogenetic incompetency and host-specificity nature (29). The same situation was observed from pond turtle in Turkey by Yildirimhan and Sahin (33). But of course unless proven by further studies including experimentation, other possibilities, like the absence of some appropriate intermediate hosts which may be essential to the development of the infective stages of helminths and vectors to convey them to the reptile species under consideration, cannot be ruled out.

The scarcity of parasitization by trematode species in the inhabitants of arid areas has been observed in many parts of the world (32). Here what applies to reptiles may also apply to other groups of vertebrates. Thus, a nice demonstration could also be presented from Iraq by comparing the component of the helminth community of rodents (3) with that of frogs and toads (25). Such a phenomenon is likely to have arisen as a direct consequence of rareness in the intermediate hosts whose

requirement is obligatory by flukes to complete their life cycles (12). This is to say some molluscs inhabiting the usual areas of the definitive hosts of the digenetic trematodes.

On the other hand, a relative richness in nematode infections in the sample of reptiles studied could be attributed to lack or loosen of complications in their life cycles and consequently to a widespread of their infective stages. According to Olsen (22), infections by nematode parasites in the vast majority of the land vertebrates are bound to happen during the terrestrial stages of the life cycle of these parasites.

The cysticercoids, which were found attached to the peritonea of geckos and the diadem snake, belong to particular members of the cyclophyllidean cestodes. Similar larvae were previously encountered in geckos and snakes from Iraq (20, 23, 26). Five species of the family Dilepididae, namely, *Diplopylidium nolleri*, *D. acanthotetra*, *Dipylidium caninum*, *D. sexcoronatum* and *Joyeuxiella pasqualei*, were found to be amongst the commonest intestinal parasites of cat in Iraq (2, 4, 21, 27). At least some of these species are also capable of infecting other carnivorous mammals, such as dog and fox (10). In other parts of the world, several species of arthropods, amphibians, lizards and snakes were incriminated as possible intermediate hosts for these tapeworms (29, 31), including the Turkish gecko *Hemidactylus turcicus* (19).

A *Thelandros* sp. was recovered in each of the 3 species of geckos used in this study. Its relatively higher infection rate in *A. elisae* may be attributed to abundance in the availability of its infective stage besides the behavioural pattern of this host. However, in every infected case only the females of this parasite were found. The deficiency represented in male absence made a specific identification of these forms impossible (6). Similar problems often faced the researchers in Iraq, for example, in respect to identification of *Thelandros* forms encountered in geckos, toads and frogs (2, 14, 25) and, elsewhere, in connection with the identification of these nematodes in the geckos (13) as well as in the tree frogs (9). In the researchers' opinion the absence of males among the encountered specimens of *Thelandros* may suggest two possibilities: either the individuals of this sex are free-living organisms or parthenogenesis is the mode of female reproduction. However, it is the first possibility, which seems more reasonable, for example, in view of the available evidence represented by actually finding males in allied species from the same hosts and localities. Thus, upon recovery and description of adequate specimens of both sexes of a form found in the recta of the rough-scaled gecko *Cyrtodactylus scaber* from northern Iraq, Hassan and Abdul-lah (14) demonstrated that they definitely belong to the species *T. micipsae*, while another existing form was reserved at the genus level because of lacking of male specimens.

It is important to remark though that approval of Adamson and Nasher's (1) hypothesis, which implies that members of the

genus *Thelandros* are basically parasites of herbivorous and omnivorous reptiles, while members of a morphologically similar genus *Parapharyngodon* exist in insectivorous reptiles and amphibians, is anticipated to have a global impact on the systematics of this group of nematodes. Therefore, the prospect of occurrence in Iraq of a number of species belonging to both of the forenamed genera should not be overlooked.

All the 7 specimens of *Microtetrameres* sp. were recovered from the house gecko *H. flaviviridis*. The majority of the members of the family Tetrameridae, to which this nematode species belongs, are actually gastrointestinal parasites of birds, such as corvids, larks, robins, herons and egrets (5, 6). Indeed, this particular nematode has already been encountered by the authors of this article in the proventriculus of some Iraqi birds like the common raven *Corvus corax* and the European robin *Erithacus rubecula*. The intermediate hosts the *Microtetrameres* nematodes use in their life cycle are insects, such as some members of the orders Orthoptera (grasshoppers, crickets, katydids and cockroaches) and Coleoptera (beetles) (18). In the researchers' opinion these observations represent cases of accidental infection by way of food ingestion, that is, the geckos come into possession of such parasites from insects harbouring their infective larvae. Their presence in geckos in a rarely parasitized site like the stomach tends to strengthen this hypothesis. It is interesting to mention that Al-Barwari and Nassir (2) and Rahemo and Ami (24), respectively, encountered adults and larvae of a *Microtetrameres* sp. in the gastrointestinal canal of *Bufo viridis*. Then basically they appraised the nature of infection of the forenamed toad by this parasite in a similar manner.

The digenetic fluke *T. stunkardi* was the only species of trematodes found in this study. The specimens of its definitive host, the Eastern Caspian turtle *M. c. caspica*, were captured from some grounds around the tributaries of Tigris River in the northern part of the country. It is not known which intermediate host(s) within the available ecosystem it makes use of in its development. However, the likelihood is that it is comparable to the situation of its allied forms. In this connection, a close phylogenetic relationship between *Telorchis* and *Opisthioglyphe* has been recently suggested (30) and in fact it is also shown that several members of both genera have a 3-host life cycle one of which is regularly a molluscan like *Lymnaea* (12). If this also applies to *T. stunkardi*, besides some other species of digenetic trematodes such as *Haplomera cylindracea* and *Opisthioglyphe ranae* both of which infect the grass frog *Rana ridibunda* (25), then it might further increase the load on the developmental capacity of the Iraqi freshwater lymneid snails. This situation in Iraq might have an advantageous impact of lowering the overall infection incidence especially by the economically and medically important species of parasites belonging to such

genera like *Fasciola*, *Paramphistomum* and *Gigantocotyle*. Indeed, it might even form a basis for a possible biological control scheme.

The systematic of the gastrointestinal nematodes of the Iraqi chelonians indicates that they belong to 2 families of the order Ascarida and 1 family of each of the orders Oxyuroidea, Spiruroidea and Cosmocercoidea. All of the 5 species encountered are cosmopolitan in distribution and have been recorded and described in many parts of the world.

The overall nematode infection rate for the 72 specimens of tortoises and turtles examined from Iraq was 46%. Such a rate is about 49% for the 22 Mediterranean tortoises to which some data is repeatedly cited in the literature. For example, upon post-mortem examination of 144 specimens, Keymer (16) also diagnosed species encompassed by the genera *Angusticaecum*, *Atractis* and *Tachygonetria*, with an overall infection rate of about 44%. As to the figure of 30% for the intestinal nematode infection in the tortoises presented by Holt *et al* (15), actually it was obtained as a result of ova identification in survey of faecal samples of 70 live animals. Obviously, this is an area which urgently requires a systematic build-up of epidemiological evidence more than sporadic experiences of chelonian producers or carers.

Most of the chelonian intestinal nematodes have evolved life cycles which are either direct or do not demand more than some transmitting agents (6, 28). The consequence of such a natural adaptability is that tortoises and turtles may be constantly exposed to the infective stages of their parasites, for example, by ingesting the embryonated ova or the free larvae or even the arthropodan intermediate hosts containing the infective larvae. The net outcome of these circumstances is an increase in the parasite burden as some of the data in Table 1 tends to demonstrate.

The present findings on the nematode species of Iraqi chelonians also point out to the existence of certain pattern of host specificity. No doubt these relationships have developed over a long period of time (7) and most likely in their natural habitats the hosts and parasites involved often maintain an effective degree of normality. This supports the idea that efficient parasites are generally capable of achieving the best locations in their hosts, but at the same time not to endanger the life of either party.

ACKNOWLEDGEMENTS

REFERENCES

1. **Adamson ML, Nasher AK,** 1984. Pharyngodonidae (Oxyuroidea: Nematoda) of *Agama yemenensis* in Saudi Arabia: hypothesis on the origin of Pharyngodonids of herbivorous reptiles. *Systematic Parasitology*, 6: 299-318.

2. **Al-Barwari SE, Nassir JK,** 1983. First record of ten species of helminthic parasites from vertebrates in Iraq. *Iraqi J Science*, 24: 101-108.

3. **Al-Barwari SE, Nassir JK, Zaia M,** 1987. Gastro-intestinal helminths of common rodents in Baghdad with the record of *Hymenolepis diminuta* from hamster. *Iraqi J Science*, 28: 299-308.

4. **Al-Saeed WM,** 1983. Studies of parasites of public health importance from cats in Mosul. M. Sc. Thesis, Mosul University, Mosul, Iraq.

5. **Anderson RC,** 2000. *Nematode Parasites of Vertebrates: Their Development and Transmission*. Second Edition. CABI Publishing, Wallingford, Oxon, UK, p.650.

6. **Baker MR,** 1987. Synopsis of the Nematoda Parasitic in Amphibians and Reptiles. Memorial University of Newfoundland, *Occasional Papers in Biology, St. John's Newfoundland, Canada,* 11: 1-325.

7. **Brooks DR,** 1989. Coevolution of helminth parasites and vertebrates. Ko RA.ed. *Current Concepts in Parasitology*. Hong Kong: University of Hong Kong Press. p. 255-267.

8. **Divers S,** 1996. Certain aspects of the veterinary care of chelonia. British Chelonia Group Symposium, April, 27, UK.

9. **Dyer WG, Williams EH, Bunkley-Williams L,** 1995. Nematode parasites of a Puerto Rican tree frog, *Eleutherodactylus coqui. Trans Illinois State Acad Science*, 88: 39-41.

10. **El-Shehabi FS, Abdel-Hafez SK, Kamhawi SA,** 1999. Prevalence of intestinal helminths of dogs and foxes from Jordan. *Parasitology Research*, 85: 928-934.

11. **Esch GW, Bush AO, Aho JM,** 1990. *Parasite Communities: Patterns and Processes*. London: Chapman and Hall, p. 157-195.

12. **Galaktionov KK, Dobrovolskiy AA,** 1998. *The Origin and Evolution of Trematode Life Cycles*. NAUKA, Sankt-Peterburg, Bulgaria, p. 404.

13. **Gupta SP,** 1959. Nematode parasites of vertebrates of East Pakistan. 1. Oxyuridae from lizards (*Gekko* and *Hemidactylus*). *Canadian J Zoology*, 37: 469-475.

14. **Hassan IS, Abdullah IA,** 1989. Helminth parasites of the digestive tract of lizards in Ninevah district, Iraq. *J Education and Science*, 9: 88-99.

15. **Holt PE, Cooper JE, Needham JR,** 1979. Disease of tortoise: a review of seventy cases. *J Small Animal Practice*, 20: 269-286.

16. **Keymer IF,** 1978. Disease of chelonians. 1. Necropsy survey of tortoise. *Veterinary Record*, 103: 548-552.

17. **Marinkelle CJ, Al-Mahdawi SK,** 1980. *Trypanosoma turcici* sp. n. (Trypanosomatida) from the Meditettanean gecko, *Hemidactylus turcicus* from Iraq. *Bull Nat Hist Res Centre (Baghdad)*, 7: 73-79.

18. **Mawson PM,** 1977. The genus *Microtetraneres* Travassos (Nematoda: Spirurida) in Australian birds. *Records South Autralian Museum*, 17: 239-259.

19. **Mimioglu M, Sayin F,** 1963. The cesticercoides in lizards (*Hemidactylus turcicus*) and their transmission to a cat. *Vet Fakul Derg, Ankara University,* 10: 103-109.

20. **Molan AL, Saeed IS,** 1986. First record of *Diplopylidium nolleri* (Skrjabin,1924) cysticercoid from Iraqi snake and geckos. *Proceedings of the Scientific Research Conference, Baghdad,* (5): 252-256.

21. **Molan AL, Al-Saeed WM, Rafiq NH, Saeed IS,** 1988. Prevalence of gastro-intestinal helminths and ectoparasites in cats from Arbil, northern Iraq. *Proceed Scientific Conference Technical Institutes Foundation, Baghdad,* 1: 355-370.

22. **Olson OW,** 1974. *Animal Parasites: Their Life Cycles and Ecology*. Baltimore, MD, University Park Press, p. 562.

23. **Rahemo ZIF, Al-Hayali KA,** 1985. New record of a Dipylid cysticercoid from an Iraqi snake. The 8th Scientific Conference of the Iraqi Biological Society, Baghdad-Iraq.

24. **Rahemo ZIF, Ami SN,** 1995. *Microtetrameres* sp. larvae (Nematoda: Tropisuridae) encysted in the stomach wall of toad, *Bufo viridis* in Iraq. *Revue Roumaine De Biologie-Biologie Animale*, 40: 19-23.

25. **Saeed I, Al-Barwari SE, Al-Harmni KI,** 2007. A metazoan parasitological research of some Iraqi amphibians. *Tr J Zool.,* (In press).

26. **Salih NE, Rahemo ZIF,** 1989. Cysticercoid of *Joyeuxiella* sp. from the wall lizards in Iraq with special reference to its cyst wall. *Rivista Parasitologia*, 6: 239-244.

27. **Salman YJ,** 1987. A Survey of the Alimentary Canal Helminths of Cats in Baghdad and Kirkuk Areas with Biological Study of *Toxocara cati* (Schrank, 1788). M. Sc. Thesis, Baghdad University, Iraq.

28. **Skrjabin KI,** 1991. *Key to Parasitic Nematodes*. E. J. Brill, Leyden. p. 1109.

29. **Smyth JD,** 1994. *Introduction to Animal Parasitology*. Third Edition. Cambridge: Cambridge University Press. p. 549.

30. **Tkach V, Grabda-Kazubska B, Swiderski Z,** 2001. Systematic position and phylogenetic relationships of the family Omphalometridae (Digenea, Plagiorchiidae) inferred from partial lsrDNA sequences. *Int J Parasitol*, 31: 81-85.

31. **Wardle RA, McLoed JA,** 1968. *The Zoology of Tapeworms*. Hafner Publishers Co., New York. p. 275.

32. **Yamaguti S,** 1958. *Systema Helminthum*. Volume 1: The Digenetic Trematodes of Vertebrates. Interscience Publishers, New York. p. 1074.

33. **Yildirimhan HS, Sahin R,** 2005. The helminth fauna of *Emys orbicularis* (European pond turtle) (Linnaeus, 1758) living in freshwater. *Turkiye Parazitol Derg*, 29: 56-62.