

# Parasitosis of the Chukar Partridge, *Alectoris chukar* in North Iraq

## Kuzey Irak'ın Kınalı Keklik (*Alectoris chukar*) Parazitleri

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### ABSTRACT

**Objective:** The aim of this study was to establish the identity of the parasitic communities of the chukar partridge from Iraq as well as reporting on the prevalence and intensity of various infections from several localities and comprising both sexes.

**Methods:** Twenty-nine live adult chukar partridge (*Alectoris chukar*) were obtained from several localities across the northern provinces of Iraq. Blood samples were examined for haemoprotozoa, carcasses were assessed for the ectoparasites throughout the body skins and feathers, and the alimentary canal was examined for protozoans and helminths.

**Results:** All of the examined animals were infected with the 18 different endo- and ectoparasite species identified. These include 2 protozoans, 3 cestodes, 2 nematodes, and 11 arthropods. The overall figures suggest no significant differences in infection indices in terms of the host's sexuality. Pathogenicity of the parasites involved is briefly emphasised. Furthermore, the role of the chukar in the dissemination of these disease agents among populations of other avian species is discussed.

**Conclusion:** With the exception of *C. latiproglottina*, all of the species differentiated represent new records for chukar from Iraq, and the 2 coccidians are new addenda to the country parasitological list. (*Türkiye Parazitol Derg* 2012; 36: 240-6)

**Key Words:** Chukar partridge, parasite, endoparasite, ectoparasite, Irak

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### ÖZET

**Amaç:** Irak'tan toplanan kınalı kekliklerde bulunan parazitlerin yaygınlığı ve yoğunluğunu belirlemek amacıyla yapılmıştır.

**Yöntemler:** Irak'ın kuzey eyaletlerinden 29 yetişkin kınalı keklik (*Alectoris chukar*) canlı olarak toplanmış, deri ve tüyler ektoparazit, sindirim kanalı protozoon ve helmintler, kan ise Haemoprotozoa yönünden incelenmiştir.

**Bulgular:** İncelenen örneklerin tümü parazitlerle enfekte bulunmuş ve hayvanlardan 2 protozoon, 3 sestod, 2 nematod ve 11 artropod olmak üzere toplam 18 farklı tür parazit saptanmıştır. Sonuçlar, konak cinsiyetine göre enfeksiyon sıklığında önemli bir farklılık olmadığını göstermiştir. Parazitlerin patojenitesi de kısaca incelenmiş, bu hastalık ajanlarının diğer kuş türleri arasındaki dağılımında kınalı kekliklerin oynadığı rol de tartışılmıştır.

**Sonuç:** *Cotugnia latiproglottina* dışında diğer türlerin tamamı Irak'ta kınalı keklikte ilk kez bildirilmekte, *Eimeria kofoidi* ve *E. caucasica* ise Irak için ilk kayıttır. (*Türkiye Parazitol Derg* 2012; 36: 240-6)

**Anahtar Sözcükler:** Kınalı keklik, parazit, endoparazit, ektoparazit, Irak

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### INTRODUCTION

The chukar partridge (*Alectoris chukar*) is a common Eurasian species. It is the most important native game bird of the northern region of Iraq (1). Two of the 14 suggested

subspecies are seen in the wild in this country, namely, *A. c. kurdestanica* and *A. c. werae* (2, 3). They are undoubtedly very similar to each other in size and other morphometric traits, general appearance and habits, to the extent that

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cross-breeding may occur between them. However, it is generally believed that the populations of these subspecies have little overlap in their geographical distributions; for example, the range of *kurdestanica* is much wider extending from Armenia across southeast Turkey and north Iraq to Iran, while that of *werae* is merely confined to certain habitats in northeast Iraq and west Iran.

The chukar partridge is known to be capable of producing hybrids with some other members of the genus *Alectoris* (2, 4). Indeed, its hybrids are often more tamed and therefore much easier to be bred and raised on a large-scale. Several nations of the Mediterranean and Middle East regions have taken the male of *Alectoris* partridge as a symbol of bravery, intelligence and wickedness, and its female as a symbol of passion and motherliness.

Parasitological studies have been conducted on a number of *Alectoris* species and subspecies in several parts of the world. A wide variety of endo- and ectoparasite species were recovered and identified from them. The first category is mainly composed of gastrointestinal protozoans and helminths, with average infection figures roughly clustering around 50%. Relevant data were made available upon many investigations, such as those of Ruff and Wilkins (5) on *A. chukar* from the USA; Vasilev (6) on *A. chukar kleini* from Bulgaria; Reck and McQuiston (7), Koroglu and Tasan (8, 9) and Perrucci et al. (10) on *A. graeca* from the USA, Turkey and Italy, respectively; Belleau and Leonard (11) and Rizzoli et al. (12) on *A. graeca saxatilis* from France and Italy, respectively; Moretti et al. (13) and Carvalho-Varela and Ferradeira (14) on *A. rufa* from Italy, Spain and Portugal, respectively, and Calvete et al. (15) also on *A. rufa* from Spain. With respect to the ectoparasites, less systematic research seems to have been done (14, 16, 17), but nevertheless reveals infestation of these birds by many species, most commonly lice, fleas and ticks.

On the other hand, the situation in Iraq, as in other Middle East countries, still lags behind. That is to say, the knowledge on *Alectoris* partridges is mostly narrative and zoogeographical. Indeed, the literature survey shows that these birds were examined with a parasitological intention on only two occasions. Arthur (18) described a few specimens carrying a new species of ixodid ticks (*Ixodes tatei*), while Sawada et al. (19) found a single specimen of a new species of davaneid tapeworms. Upon the description of the latter, the name *Cotugnia latiproglottina* was assigned to it (typewritten in the original abstract as *C. paucitesticulata* by mistake).

The present study, therefore, aims to establish the identity of the parasitic communities of the chukar partridge from Iraq as well as reporting on the prevalence and intensity of various infections. The sample size employed was much larger than the preliminary ones referred to above, as well as being more representative by virtue of obtaining it from several localities and comprising both sexes.

## METHODS

The study depended on examining 29 (11 male and 18 female) chukar partridge, *Alectoris chukar* (Gray, 1830) (Galliformes, Phasianidae). All of the specimens were adult and older than one year, as judged from the observation of the plumage pattern and

weight. Sex differentiation was always confirmed by gonadal checking. The birds were obtained alive from hunters or dealers on different occasions from several localities across the northern provinces of Iraq. The vast majority of them were recognised as *A. c. kurdestanica* Meinertzhagen, 1923, and only a couple (probably 3) as *A. c. werae* (Zarudny and Loudon, 1904). Accordingly, no attempt was made to discriminate the parasitological data on the basis of the host subspecies.

Each bird was given a thorough examination with the results showing that almost all of them were vigorously active. None of them showed injuries, marked skin lesions (such as hyperdermatosis, epidermitis and acanthosis) or excessive feather loss or damage. However, some of them discharged moistened faeces and a pair had severe diarrhoea. The latter exhibited poor feeding and drinking and their bodies were markedly dehydrated.

The respective average figures of 6 morphometric parameters that were determined for 10 male and 10 female chukar specimens were as follows: body length (bill to tail) 36.4 and 31.7 cm, body mass 703.8 and 448.5 g, wing cord 47.9 and 45.9 cm, tail length 83.3 and 80.5 cm, tarsus length 47.5 and 43.9 cm, and bill length 15.0 and 14.4 cm.

Blood samples were employed following a procedure specified by Al-Barwari and Saeed (20). From each partridge, a small amount of blood was drawn from the wing vein. This was prepared into thin smears that were air-dried, fixed in absolute methyl alcohol and stained following the Giemsa method (5%, pH 7.2). The slides were microscopically examined for the presence or absence of haemoprotozoa.

Partridge carcasses were assessed for the ectoparasites throughout their body skins and feathers. Wherever found, these organisms were mostly removed by fingers and sometimes by small forceps. Preservation, clearance, staining and species differentiation of these parasites were also performed as described previously (20). The same was applied to the determination of the prevalence rates and intensities of infection for each species and for both sexes of the host.

Evisceration of each bird was then performed and the alimentary canal was opened by a longitudinal incision. Fresh samples of the contents of and scrapings from the mucous membranes of each part (mouth, oesophagus, crop, stomach, gizzard, small intestine, rectum and caeca) were transferred to glass slides, mixed with drops of saline, covered with coverslips and examined microscopically for protozoans, helminth segments and ova. Livers and gallbladders were examined for trematodes, and tracheas for nematodes. Upon finding the adult helminths, they were collected separately from each bird, cleared in saline, counted, identified as far as possible, fixed in 70% ethanol, and then stored in 70% ethanol + 5% glycerine for subsequent use.

Standard procedures were frequently employed for the purpose of permanent preparations of any gastrointestinal protozoan, cestode and nematode parasites that were present. Definite identification to the species level was achieved by studying the characteristic features of the parasite forms. A floatation technique was often employed to confirm the identification of *Eimeria* species; it was also used to arbitrarily determine the

infection density for these parasites, for example, by designating 1+ for asymptomatic infection and where relatively only small numbers of oocysts were detectable; 2+ for moderate infection and symptoms, such as slight diarrhoea; and 3+ for acute symptoms, including severe diarrhoea, emaciation and inappetence.

## RESULTS

The total number of parasite species encountered in and on the chukars was 18. Thirteen (44.8%) of the specimens examined were found to harbour at least one helminthic species. However, when combined with the results on ectoparasites, all of the host specimens were found to be parasitised with one or more species. Indeed, about 50% of the partridges harboured 7 or more species of parasites simultaneously.

Table 1 Lists the scientific names of the parasites that were found together with their infection sites in or on both sexes of the host, as well as the respective infection rates and parasite burdens. Internal infections were only encountered in the small intestine and caeca. The upper digestive tracts of all of the sampled chukars were found to be negative for the infection by the flagellate protozoan *Trichomonas gallinae*, and no haemoproteoans, like *Haemoproteus* and *Plasmodium*, were detected in blood smears or trematode species in livers or gallbladders. The mouth, oesophagus and crop of all of the sampled chukars revealed no infection with *Capillaria* nematodes. Also, the tracheas of all specimens were found to be free of infection by helminths like

the gapeworm *Syngamus trachea*. However, two species of intestinal protozoans, three species of intestinal tapeworms, one species of intestinal and another of caecal nematodes, and 11 species of ectoparasites were identified.

The two eimeriid protozoans recovered were identified as *Eimeria kofoidi* Yakimoff and Malikaschwili, 1936 and *E. caucasica* Yakimoff and Buewisch, 1932. The host site preference for either of the above species is the small intestine. Their prevalence was moderately higher in female than male hosts. The index of parasite burden, although only arbitrarily measured for infection by these species, tends to suggest the existence of an association between the intensity of infection and severity of symptoms in the diseased specimens.

The three forms of tapeworms differentiated were all found to be davaineid species, namely *Raillietina (Raillietina) tetragona* (Molin, 1858), *Cotugnia latiproglottina* Sawada et al. (19) 1990 and *Choanotaenia infundibulum* (Bloch, 1779). The vast majority of the specimens were bound through their scolices to the mucosa of small intestine, but some were present free in the lumen of this organ. Male chukars seemed to be more prone to parasitisation by anyone of these tapeworms than the female counterparts, but it is unclear whether that is in terms of prevalence or intensity.

One of the two nematode species that were identified, namely *Heterakis gallinarum* (Schrank, 1788) was encountered in the

**Table 1.** Parasites harboured by the chukar partridge from north Iraq together with the infection indices in male and female sample

Parasite name	Infection site	Infection rate (%)*		Parasite burden**	
		♂	♀	♂	♀
<i>E. kofoidi</i> ***	Intestine (oocystic in faeces)	36.4	50.0	1+-2+	1+-3+
<i>E. caucasica</i> ***	= = = =	27.3	44.4	1+-3+	1+-3+
<i>R. (R.) tetragona</i>	Small intestine	27.3	16.7	2.3	2.7
<i>C. latiproglottina</i>	= =	18.2	11.1	6.0	3.0
<i>C. infundibulum</i>	= =	9.1	0	2.0	0
<i>H. gallinarum</i>	Intestinal caecum	18.2	27.8	4.0	2.4
<i>A. galli</i>	Small intestine	9.1	16.7	1.7	1.3
<i>M. cornutus</i>	Body skin	45.5	38.9	54.2	27.6
<i>C. columbea</i>	Wing feather and skin	9.1	22.2	2.0	3.8
<i>G. dispar</i>	Feather and skin	9.1	5.6	7.0	28.0
<i>C. heterographus</i>	Head and neck	0	11.1	0	10.5
<i>L. caponis</i>	Wing feather and skin	0	5.6	0	7.0
<i>C. lectularis</i>	Body skin	9.1	11.1	2.0	1.3
<i>C. felis</i>	= =	18.2	0	1.5	0
<i>D. gallinae</i>	= =	9.1	16.7	1.7	2.3
<i>I. frontalis</i>	= =	9.1	5.6	2.0	1.0
<i>H. asiaticum</i>	= =	0	11.1	0	1.0
<i>A. persicus</i>	= =	27.3	16.3	3.3	2.7

\*The average percentage of prevalence of the parasite species among all the host's specimens sampled

\*\*The infection intensity or the average number of the parasite individuals in the infected cases

\*\*\*Intensity of infection is arbitrarily determined (see Materials and Methods)

caeca, whereas the second species, *Ascaridia galli* (Schrank, 1788), was found in the small intestine. The posterior extremity of an adult male of the latter species revealed some minor morphological variations in comparison with the specimens commonly found in Iraqi poultry (chicken, turkey and duck). For both of these nematode parasites, it was the female chukar that showed the higher susceptibility for infection, while the opposite was noted in respect to the index of parasite burden.

The study encountered 11 species of ectoparasites. Seven of them were insects, comprising five Mallophaga, namely, the small body louse *Menacanthus cornutus* Schrommer, 1913, the feather louse *Columbicola columbae* (Linnaeus, 1758), the large louse *Goniodes dispar* Burmeister, 1838, the head louse *Cuclotogaster heterographus* Nitzsch, 1866, and the wing louse *Lipeurus caponis* (Linnaeus, 1758); one Heteroptera, the common bed bug *Cimex letularius* Linnaeus, 1758, and one Siphonaptera, the common cat flea *Ctenocephalides felis* (Bouche, 1835). The other four species were Arachnida, the first an Acarina, the poultry red mite *Dermanyssus gallinae* (De Geer, 1778), and the second, third and fourth Acari, the front hard-bodied ticks *Ixodes frontalis* (Panzer, 1798), Asiatic hard-bodied tick *Hyalomma asiaticum* Schulze and Schlottke, 1929, and Persian poultry soft-bodied tick *Argas persicus* (Oken, 1818).

Harbouring of chukar to ectoparasite species revealed a wide range of variability in terms of prevalence (approximately 0-46% in males and 0-39% in females). The highest sex-combined infestation rate recorded was for *M. cornutus*, followed by *C. columbae* and then *D. gallinae*; whereas the lowest such rate was for *L. caponis* and *H. asiaticum*, where in either of them only a single case of infection was found (Table 1). Differences were also detected with respect to parasite burden (approximately 0-54 in males and 0-28 in females), again with higher average figures for *M. cornutus* but followed by *G. dispar*; whereas the lowest burden was in *H. asiaticum* followed by *C. felis*.

## DISCUSSION

A couple of the chukar specimens suffering from acute diarrhoea were constantly lighter in weight than the rest. They often harboured more parasite species, with coccidians always being present in their intestines. This finding supports a previous one made on the rock pigeon, which indicated that some of the biometric measurements might turn out to serve as an arbitrary indicator of the general health status of the adult bird (20).

Examination of the chukar for endo-parasitosis revealed its infection with cestodes and nematodes besides coccidians, but not with any trichomonal, blood protozoan, trematode or acanthocephalan species. This, in a general sense, is in agreement with what one would expect in the structure of the parasitic communities of this species; partly because of being a seedeater and preferring dry and rocky habitats, and partly in light of the results obtained by several other researchers in comparable ecosystems. However, Millan et al. (21) were able to record for the first time a *Haemoproteus* sp. in *A. rufa* from Spain. Also, few digenetic trematodes, such as *Brachylaemus fuscatus*, *Dicrocoelium petrovi* and *Dicrocoelium* sp., have been recovered from adults of other *Alectoris* partridges (6, 11, 12, 15, 22). The absence of

*Trichomonas* infection in partridges may be explained through the mode of their feeding that does not involve "crop milk", even at a very early age after hatching, without totally eliminating the possibility of some inherited resistance to such infection. The scarcity of blood parasites in these birds is likely to be due to the scarcity of vector agents, but again without eliminating the possibility of some immunological resistance and probably the density of the definitive hosts in that matter. As to the relevance to trematodes, they may well be related to the availability of ill-suited intermediary hosts, which are essential to the survival of their infective stages as well as their free-living stages surviving the outside physical and environmental factors.

The present study showed that at least two species of eimeriid coccidians (*E. kofoidi* and *E. caucasica*) are capable of parasitising the Iraqi population of chukar. Besides Russia, which is the country in which they were first discovered, both were also found to be widely distributed among the partridge species in some other countries, for example, 76% and 38% of *A. graeca* from Turkey, respectively, and *E. kofoidi* in 59% of *A. graeca* in the USA (7, 8, 23, 24). It is worth mentioning here that the total number of *Eimeria* spp. described from *Alectoris* partridges may have reached 13 (10, 25, 26). However, several of them are widely looked upon as being synonyms of only two or three genuine ones, that is, those which were also recovered in this study and *E. alectorae* (27, 28). The latter species was first found in the chukar from India.

The varied pathogenicity produced by coccidian parasites in the sampled partridges was comparable to that observed elsewhere by others (5, 11, 13, 14). That is to say, such infections may or may not be associated with clinical symptoms of acute disease. This suggests that mild infection of these birds by the gastrointestinal coccidians, similar to the situation in poultry and many other species, might be of little effect if not of some advantage to them due to the development of an immunological mechanism (27, 29). Several anti-coccidial drugs have been tried in chukar partridges, such as ormetoprim, sulphamethazine, amprolium, dinitolmide, monensin, lasalocid, and sulphonamides. However, it is a medication through feed with sodium sulphamethazine, or a 5:3 mixture of sulphadimethoxine and ormetoprim (Rofenaid), which is apparently much more effective in the treatment and prevention of this type of parasitism in these birds (5, 7).

The tapeworm *C. latiproglottina* was first described by Sawada et al. (19) in chukar from north Iraq. They encountered it as a single mature, non-gravid worm in the small intestine of one out of three *kurdestanica* specimens obtained from Hareer County, east of Erbil province. The original description of its specific characteristics were found to be justifiable, for example, it is similar to *C. transvaalensis* Ortlepp, 1963, which was first recorded from the Guinea fowl, but differ from it by having no less than 3-fold longer strobila, a longer vitelline gland and a more massive ovary, with the outline of the latter organ being finally and not coarsely lobated. The present study also extends the epidemiological knowledge pertinent to the infection of chukars by this parasite.

With regard to the two other species of tapeworms found (*R. (R.) tetragona* and *C. infundibulum*), this is the first record of their

presence in partridges from Iraq. However, both of them have been reported in these birds from some other places, for example, the former with a prevalence of 6.0% in *A. graeca* from Turkey (9), and 8.6% (intensity of 1-5) in *A. rufa* from Spain (15); and the latter with a prevalence of 4.0% in *A. graeca* from Turkey (9), and 8.6% (intensity of 1-10) in *A. rufa* from Spain (15).

The fact that the tapeworm species mentioned above are capable of producing diseases in poultry reveals the importance of encountering them in this study (29). Furthermore, they are also capable of infecting several other avian species. In as far as Iraq is concerned, *R. (R.) tetragona* has been found in 18.5% (intensity of 4.7) of chickens from Mosul (30), 0.2% of domestic pigeons from north of Iraq, 16.0% (intensity of 2.2) of rock pigeons from various localities, and 16.0% (intensity of 2.5) of the white-cheeked bulbuls from around Baghdad City (20, 30-32). This species was also found to infect the Iraqi populations of the domestic pigeon and wood-pigeon (*C. palumbus*), which in the latter host exhibited discernible seasonal variations (33, 34). As for *C. infundibulum*, it has been identified in 18.5% (intensity of 6.7) of chickens from Mosul district (30).

The findings of two species of nematodes (*H. gallinarum* and *A. galli*) represent new records in chukar from Iraq. However, both of them have been identified in some other partridge species from abroad. For example, the prevalence of the former was about 1.0% of *A. rufa* from the United Kingdom, 12.0% of *A. graeca* from Turkey, and about 1.2% (intensity of 1.0) of *A. g. saxatilis* from Italy; the latter totalled 5.0% (intensity range of 2-27) of *A. rufa* from Spain (9, 12, 15, 17).

The above nematode species have also been found in other avian species from Iraq, for example, *H. gallinarum* in 45.8% (intensity of 39.4) of chickens from Mosul, and *A. galli* in 56.4% (intensity of 29.6) of chickens from Mosul, 0.5% (intensity of 25) of domestic pigeons from the north of Iraq, and in 6.4% (intensity of 2.6) of rock pigeon from various localities (20, 30, 31). As is well documented, the deleterious effect of *H. gallinarum* may stretch beyond its own parasitisation, for this caecal worm is an important vector of the virulent flagellate protozoan *Histomonas meleagridis*. According to Potts (17) and Calnek (29), histomoniasis (blackhead disease) may be a cause of a considerable number of deaths in the partridge population, as is the case in many other species of gallinaceous birds in the wild where the food comprises insects and other invertebrates, like earthworms.

In agreement with the findings of Rizzoli et al. (12) on the rock partridge from Italy and Al-Barwari and Saeed (20) on the rock pigeon from Iraq, the data of the present study revealed that the association between chukar sex and the overall prevalence rate or infection intensity of any main category of gastrointestinal parasites was not significant.

Parallel to their parasitisation with endoparasites, the infestation of the chukars with ectoparasites was found to be a common phenomenon in north Iraq. A comparable situation was found regarding infestation of the red-legged partridge *A. rufa* in Spain and Portugal (14, 16). The latter researchers identified and analysed the data relevant to 13 helminthic (one trematode, four cestodes and eight nematodes) and nine ectoparasite species

(six chewing lice and three ticks). Generally speaking, the observations made by them, like those of Al-Barwari and Saeed (20) on the rock pigeon, would suggest that the overall intensity of infestation by lice is primarily controlled by environmental factors. However, the data of the present study as a whole do not collate with that of Calvete et al. (16) regarding a greater association between louse species infestation and male but not female partridges. This is true, whether investigating intensity of infestation or species richness.

The 11 species of ectoparasites identified from the chukar collectively represent a new record for this host from Iraq. However, the lists presented in previous studies in this country, such as those of Al-Barwari and Saeed (20), Al-Hubity (30), Khalaf (35), Abul-Hab (36), and Abdul-Karim et al. (37), would reveal that all of the species have been fairly well recorded. Which of them is also an actual parasite of chukar and which is incidentally encountered due to contamination from other more suitable sources is difficult to say with certainty until further samples are analysed. What can be inferred from observations already made in Iraq is that *M. cornutus*, *G. dispar*, *C. heterographus*, *L. caponis*, and *D. gallinae* are commonly found on chickens and other poultry; *A. persicus* is also prevalent among chickens in north Iraq, with high infection rates and heavy parasite burdens in some localities that are difficult to cope with (38); *C. columbae* is a specific parasite of pigeons and doves; while the rest of species encountered parasitise a range of mammals, including humans, as well as many birds. The ixodid tick *I. tatei* was not encountered in this study. This parasite was first described in Iraq by Arthur (18) from the common red fox *Vulpes vulpes*, as well as from the chukar, upon which it preys. The prevalence rates of ectoparasites and the intensity of their infection reported by the above sources from Iraq varied considerably due to variation of such factors like the host species, seasonality, geographical location within the country and nutritional status. As far as the overall differences in the parasitisation of the two sexes is concerned, the averages of the global data for all species involved in the present study tend to suggest that the individual findings may not be as significant as they appear. In other words, the observed differences are perhaps due to such factors like small sample size, the source, and the ecological circumstances and duration of confinement before examination, more than to the impact of some host-specific intrinsic factors like hormones.

The infection indices for any one of the ectoparasites encountered was generally found to be low and probably not of sufficient severity to be solely responsible for the production of clinical symptoms of illness or alterations in the physiological conditions of the host. However, as discussed by Calnek (29), Calvete et al. (16), and Al-Barwari and Saeed (20), they should be looked upon not only as obligate external parasites but also under certain circumstances where the defence mechanisms are weakened (such as in sick, deformed or senile birds), food deprivation, and heavy and prolonged infection with blood and intestinal parasites, as being capable to populate rapidly and causing serious health deterioration, sexual selection, reduction in fecundity and even mortality of the host by predation or otherwise. What should also be emphasised is the vectorial and reservoir roles of these arthropodan parasites, and the fact that some of

them act as intermediary hosts to a number of helminthic parasites. Of special interest in this regard was the recovery in this study of 2 specimens of the Asiatic hard tick *H. asiaticum*. This ixodid species is among a number of suspected vectors that may play a role in the transmission of the causative agents of some deadly diseases in Iraq from animals to humans, such as CCHF and RVF viruses (39, 40). The researchers were informed that the source of both partridges carrying these ticks was a north-eastern area not too far from the border with Iran.

## CONCLUSION

The researchers recommend carrying out periodic investigations on both endo- and ecto-parasites of the chukar partridge, as well as any other Iraqi wild species wherever possible. This approach will be useful to evaluate the wildlife situation and perhaps also sense the dangers of dissemination of some of the parasitic species to the economically important animals, pets and humans themselves. A policy involving the strict prevention of infection should be employed to prevent the possibility of introduction of an extinct as well as a new species to a particular territory of the country. As emphasised by Tompking et al. (41), parasite-mediated competition between different species need to be defined and dealt with wherever possible. The likelihood of any potential interaction between autochthonous and allopatric species is threatening and should be avoided as much as possible.

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## Conflict of Interest

No conflict of interest was declared by the authors.

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