

## Article

### **First report of *Ixodes (Pholeoixodes) hexagonus* on chukar (*Alectoris chukar*) in Northwest of Iran and its public health importance**

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#### **Abstract**

Ixodid ticks are obligatory blood-sucking ectoparasites of various mammals, birds, reptiles and vectors of different agents of diseases in both man and livestock. *Ixodes hexagonus* was reported from different parts of the globe and it is important as a vector of different diseases such as Lyme disease. A total of 53 chukars were sampled. The birds were obtained from hunters or dealers on different occasions from several localities across the south of Urmia city, West Azerbaijan of Iran. In this study, we report infestation of *I. hexagonus* in chukar and it is the first report of *I. hexagonus* from Iran. The results indicated that 28 chukars were infected by ticks. Considering that the *I. hexagonus* is one of the major vectors of *Borrelia burgdorferi*, *Babesia microti* and *Rickettsia conori*, the report of this tick in this region could mean more disease transmission. More attention should be given to the search of this parasite in similar geographical regions in Iran. Additionally, molecular work should be done to show the importance of *I. hexagonus* tick in the transmission of different diseases especially Lyme borreliosis.

**Keywords:** Female, infestation, larva, Lyme disease, nymph, ticks.

#### **Introduction**

The chukar partridge (*Alectoris chukar*) is native to the mountainous regions of Asia, Western Europe and the Middle East (Rasmussen and Anderton 2005; Robinson 2007). Its natural range includes Turkey, the Mediterranean islands, Iran and east through Russia and China and South into Pakistan and Nepal (Hayes 1995). It is native and widespread in the western Himalayas of India where it is found to an altitude of 5000m (Ali and Ripley 1983). Chukar partridges have been introduced widely for game hunters and have become established in the USA, Canada, England, New Zealand and Hawaii (Rasmussen and Anderton 2005; Robinson 2007).

Phylum Arthropoda contains over 80% of known animal species that exist in almost every habitat. As a result of their activity, arthropod ectoparasites may have a wide range of direct and indirect effects on their hosts. Ixodid ticks are obligatory blood-sucking ectoparasites of various mammals, birds, reptiles and vectors of different agents of diseases in both man and livestock, like tick-borne encephalitis virus, *Borrelia*

*burgdorferi*, *Anaplasma phagocytophilum*, *Rickettsia helvetica*, *R. conorii*, *Babesia canis*, *B. divergens*, *B. microti*, which produce tick paralysis in the host (Nijhof *et al.* 2007; AHAW 2012; Nowak Chmura and Siuda 2012).

*Ixodes hexagonus* (Leach) is widespread in Western Europe; in most of the region it is second in abundance to *I. ricinus*. Further afield, it ranges from North Africa through Eastern Europe to Southern Asia. Though the genus *Ixodes* are the most populated group in the world, it is represented by 9 species; *Ixodes crenulatus*, *I. frontalis*, *I. gibbosus*, *I. hexagonus*, *I. laguri*, *I. redikorzevi*, *I. ricinus*, *I. simplex* and *I. vespertilionis* (Hillyard 1996).

Knowledge of biological models of tick parasitism in wildlife is very useful to clarify factors that have permitted a few tick species to become economically important pests and vectors of disease agents to man and animals. Birds are important reservoirs and transmit ticks and spirochetes inter-continently. Lyme disease is a multisystem disorder involving the skin, joints, heart, and nervous system. The etiological agent is a spirochete species complex, *B. burgdorferi sensu lato*, which is transmitted via infected ticks of the *I. ricinus* species complex. However, *B. burgdorferi sensu lato* has been found in other ticks, such as *I. hexagonus*, *I. canisuga*, and *Dermacentor reticulatus* (Gern *et al.* 1991).

### Material and methods

The study depended on examining 53 chukar partridge, all of the specimens were adult and older than one year, as judged from the observation of the plumage pattern and weight. The birds were obtained from hunters or dealers on different occasions from several localities across the south of Urmia city, West Azerbaijan of Iran. This area is semi-humid, with mean rainfall of about 350 mm with the maximum mean temperature of 28.3 °C in August and the minimum mean monthly temperature of -5 °C in January (Tavassoli *et al.* 2010). This study was carried out over a 14 month period from the fall of 2012 to the fall of 2013, during two hunting seasons. After hunting, the feathers of the head, neck, and body and under the wings were raised and thoroughly examined for ectoparasites.

Ticks were collected with forceps from the chukar and were immediately placed into screw-capped tubes containing several minute holes. Vials were properly identified and conditioned under room temperatures for few days or weeks, and then they were sent to the laboratory. The purpose of this procedure was to maintain ticks alive inside the vials until arriving at the laboratory for taxonomic identification. Ticks were morphologically examined under the stereo microscope and identified using the identification keys (Hillyard 1996).

### Results

A total of 53 chukars were sampled. The results indicated that 28 chukars were infested with ticks. A total of 97 ticks were collected from infested birds. Ticks were attached only to the neck of chukars. All ticks were determined to be *I. hexogenus* (Figs. 1–3). These 97 individuals of *I. hexagonus* consisted of 22 females, 51 nymphs and 24 larvae. The internal spur on coxa I in adult female is distinguishes *I. hexagonus* from *I. canisuga* and *I. lividus*. However, because of the spur on coxa I, *I. hexagonus* can be mistaken as *I. ricinus*. In *I. hexagonus*, palp (article II plus III) is slightly shorter than

width of basis. Scutum characteristically shaped hexagonal shape. In nymphal form, scutum is heart shaped and internal spur on coxa I is shorter than female. Overall length of unfed nymph is 1.2 –1.4 mm (Hillyard 1996).

### Discussion

Ticks have a major role in disease transmission, anemia, dermatosis, paralysis, and otoacariasis. Diseases such as Crimen–Congo haemorrhagic fever, Q fever, Boutonneuse fever, and Rocky Mountain spotted fever are examples that show their impact on medicine and veterinary. Thus, the study of these ticks has become a matter of the highest importance in connection with the prevention of the diseases. Tick-borne diseases are of increasing public health concern because of range expansions of both vectors and pathogens (Margos *et al.* 2011). Lyme borreliosis is the most common arthropod-borne human disease in temperate regions of the northern hemisphere. The causative agents of Lyme borreliosis (and other tick-borne borrelioses) are spirochaetes belonging to the *B. burgdorferi sensu lato* species complex. It is well known that *B. burgdorferi* are unique among the pathogenic spirochaetes by requiring obligate blood-feeding arthropods for their transmission and maintenance in vertebrate host populations.



**Figure 1.** *Ixodes hexagonus* - Ventral view of body, coxa I with internal spur.



**Figures 2–3.** *Ixodes hexagonus* - 2. Larva; 3. Nymph.

All known causative agents of borrelioses circulate between ticks and wide variety of vertebrates' species (mammals, birds and reptiles). Consequently, *Borrelia* populations are shaped by the dynamics and demographic processes of host and vector populations, host and vector immune responses and extrinsic a biotic factors (e.g. combination of temperature, humidity and types of climate and landscape) affecting host and vector populations (Margos *et al.* 2011).

*Ixodes hexagonus* has been found to be infected with *B. burgdorferi* (Lyme disease) in England and Germany, especially in urban areas. It has been shown to be capable of transmitting the spirochaete transovarially and transstadially (Robinson 2007). In mainland Europe the tick may also be infected with *Babesia microti* (human babesiosis) and *Rickettsia conori* (boutonneuse fever). *Ixodes hexagonus* is suspected of transmitting the virus which causes tick-born encephalitis (TBE); the virus survives transovarially and transstadially (Tovornik 1987; Hillyard 1996; Bursali *et al.* 2011; Nowak Chmura and Siuda 2012).

Lyme disease has become a common infectious disease in the US and Eurasia but it is rare in Iran. Lyme disease presents with diverse clinical signs and symptoms and several variations in the course of the disease (Bursali *et al.* 2011). Lyme disease is also present in other parts of the world including Asia, Japan, Australia and South Africa (Mayne 2001; Masuzawa 2004; Strijdom and Berk 2004; Rizzoli *et al.* 2011).

There have been several reports of Lyme disease from Iran (Tabatabaei and Siadati 2006) and considering that the *I. hexagonus* is one of the major vectors of this disease. The reports of this tick in a region could mean more disease transmission.

More attention should be given to the search of the parasite on similar geographical regions in Iran and molecular work should be done to show the importance of *I. hexagonus* tick in transmission of different diseases especially Lyme borreliosis.

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## نخستین گزارش کنه *Ixodes (Pholeoixodes) hexagonus* از کبک (*Alectores chukar*) از شمال غرب ایران و اهمیت بهداشتی آن

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### چکیده

کنه‌های ایکسودید انگل‌های خونخوار پستانداران مختلف، پرندگان، خزندگان بوده و ناقل بیماری‌های مختلف در انسان و حیوانات اهلی هستند. گونه *Ixodes hexagonus* که از مناطق مختلف جهان گزارش شده است، ناقل بیماری‌های مختلف از جمله بیماری لایم است. این مطالعه بر روی ۵۳ قطعه کبک شکار شده توسط شکارچیان در مناطق مختلف اطراف شهرستان ارومیه مرکز استان آذربایجان غربی انجام شد. در این مطالعه آلودگی کبک به کنه *I. hexagonus* برای نخستین بار از ایران گزارش می‌شود. نتایج حاکی از آلودگی ۲۸ قطعه کبک به این کنه داشت. با توجه به این‌که این کنه یکی از ناقل‌های *Borrelia burgdorferi*، *Babesia microti* و *Rickettsia conori* است، گزارش کنه مزبور از منطقه نشان‌دهنده احتمال انتقال بیشتر این عوامل بیماری‌زا را می‌دهد. پیشنهاد می‌شود مطالعات بیشتری در مورد وجود این کنه در دیگر مناطق کشور که شرایط جغرافیایی همانند منطقه تحت مطالعه را دارند انجام شود. افزون بر این، کارهای مولکولی برای نشان دادن اهمیت *I. hexagonus* در انتقال بیماری‌های مختلف از جمله لایم بورلیوزیس باید انجام شود.

واژگان کلیدی: کنه، آلودگی، ماده، نوچه (پوره)، لارو، بیماری لایم.

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