

## Original Article

### **The Seasonal Activity of *Ixodes ricinus* Tick in Amol, Mazandaran Province, Northern Iran**

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#### **Abstract**

**Background:** The present study aimed to demonstrate the seasonal activities of *Ixodes ricinus* at the pasture level and on the host.

**Methods:** A vast pasture in Amol countryside (Mazandaran Province, Iran) which had the potential for a considerable number of cattle and sheep to graze was chosen. Tick sampling from the skin of 130 cattle and 130 sheep were collected every month interval. Simultaneously, the activity of the different stages of *I. ricinus* on the pasture was considered by dragging method. The collected ticks were placed in jars containing 70% alcohol and sent to the parasitological laboratory for identification.

**Results:** The rate of the infestation with adult *I. ricinus* in cattle and sheep increases gradually with the beginning of fall and reaches its peak in January, February and March while it starts to decline with the beginning of spring as the infestation rate reach to zero in summer months. Accordingly, the highest number of adult *I. ricinus* existed on the cattle during January, February, and March. In addition, the results of dragging have been revealed that the active tick population in the pasture exists during November, December, January, and March.

**Conclusion:** *Ixodes ricinus* is regarded a common tick species in Amol (Mazandaran). Due to the biological properties of *I. ricinus* which is active in the cold and humid months of the year, the prevalence of ruminant infestations with *I. ricinus* in this area increases from November to March but reaches to zero again with the beginning of summer.

**Keywords:** *Ixodes ricinus*, seasonal activity, Iran

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#### **Introduction**

Ixodid tick is one of bloodsucker arthropods belonging to acarina, which cause damage to the host skin and anemia in addition; ticks are also the most important vectors of diseases. In this regard, *Ixodes ricinus* is the one of the important vectors of highly pathogenic agents affecting both humans and domestic animals worldwide (Kettle 1995). Recently, there has been an increase in the amount of attention paid to ticks as they are vectors for pathogenic agent such as: the spirochete *Borrelia burgdorferi* etc. Conse-

quently, numerous researchers in world-wide are engaged in studies on dispersal and seasonal activity of *I. ricinus* and on the extent of their infestation with *B. burgdorferi* (Grey et al. 1992, Talleklint et al. 1993, 1996, Hubalek et al. 1998, Nilison 1998, O'Connell et al. 1998). There are many studies carried out so far related to the tick fauna in Iran, a number of studies have been conducted in northern part of Iran to investigate the tick diversity.

Razavi et al. (2006) showed that only 86%

of the 696 ticks infesting cows in Amol area were *I. ricinus*, while in Kelardasht area *I. ricinus* comprised 26.8% of the 798 collected hard ticks (Yossefi et al. 2008). Nabian et al. (2007) showed 2.32% of the 1720 collected ticks were *I. ricinus*. Razmi et al. (2007) showed that 6.8% of the population of the collected ticks from Mazandaran Province included *I. ricinus*. The important point related to the studies so far conducted in northern part of Iran is that the seasonal activities of tick fauna has not been conspicuous, although some works has pointed out the tick seasonal activity in Western Azerbaijan (Rahbari et al. 1995, Davudi et al. 2008, Salari et al. 2008) but, it is still a gap in tick ecology.

The present study aimed to demonstrate the seasonal activities of *I. ricinus* on the host and at the pasture level.

## Materials and Methods

A vast pasture in Amol countryside (Mazandaran Province, northern Iran) which had the potential for a considerable number of cattle and sheep to graze was chosen. Tick sampling from the skin of 130 cattle and 130 sheep were collected in every month interval from October 2009 to September 2010. Simultaneously, an area of 250 m<sup>2</sup> of the pasture randomly selected for dragging and the activity of the different stages of *I. ricinus* on the pasture was considered. The collected ticks were placed in jars containing 70% alcohol and were then sent to the laboratory. Tick identification was done according to the morphological structures mentioned by Estrada-Pena et al. (2004). Climatological data were also collected from central station of Amol.

## Results

In this study, six species of hard ticks (Ixodid ticks) have been identified including

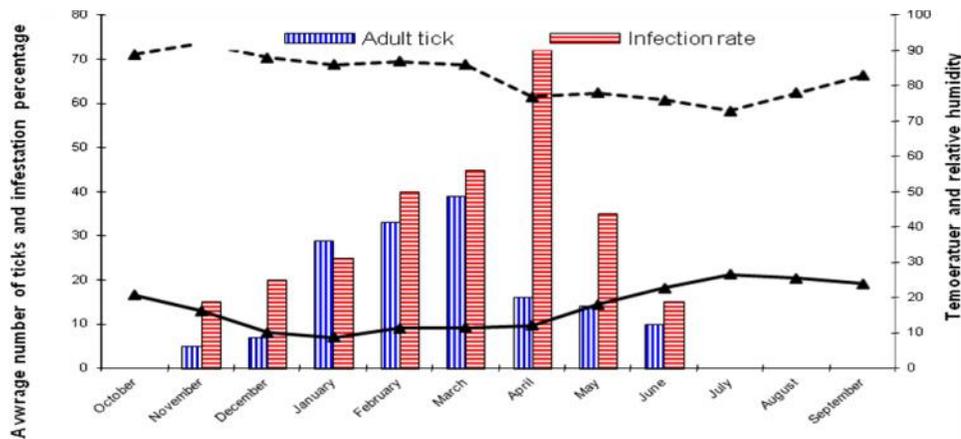
*I. ricinus*, *Boophilus annulatus*, *Rhipicephalus bursa*, *Rh. turanicus*, *Haemaphysalis concinna*, *Hyalloma deteritium* and *I. ricinus* were allocated 42% of total ticks. Monthly inspection of target animals for *I. ricinus* tick revealed that the rate of infestation in cattle with adult *I. ricinus* increased gradually with the beginning of fall and reached its peak in January, February, and March while it started to decline with the beginning of spring as the infestation rate reached to zero in summer. (Fig. 1). Accordingly, the highest number of adult *I. ricinus* existed on the cattle during winter (Table 1).

The observations showed that the occurrence of infestation with adult *I. ricinus* in sheep starts in November and continues to June. In this process, the percentage rate of infestation with adult *I. ricinus* in sheep increases gradually in fall and reaches its peak in January, February, and March. However, it declines with the beginning of spring in a way that no tick was picked up from sheep in the target area in July, August, and September (Fig. 2), while the greatest average number of adult *I. ricinus* tick on each animal was found during January, February, and March (Table 1). In addition, the tick intensity on cow and sheep was 13.81 and 6.45 respectively (Table 1).

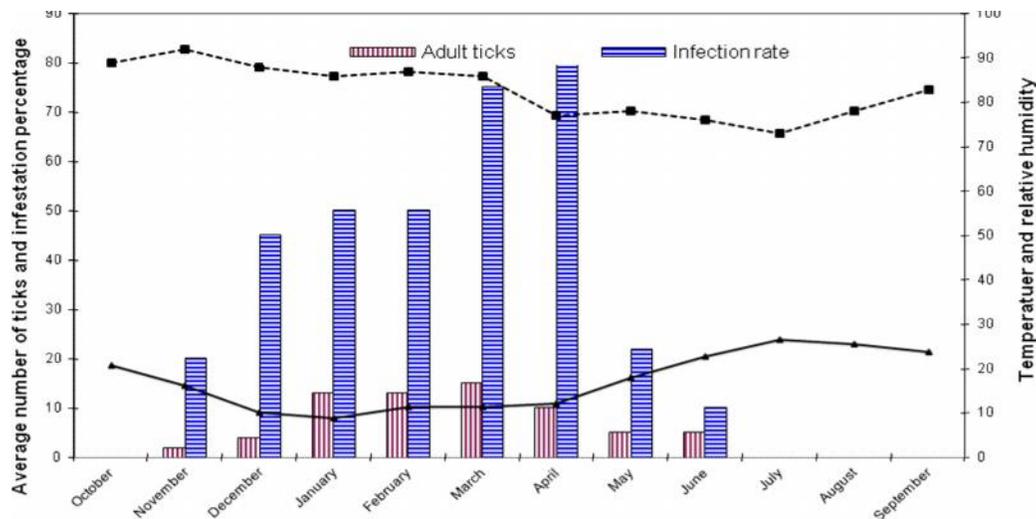
Simultaneous with tick collection from the body of the animals in the target area, the activity of the different stages of *I. ricinus* on the pasture was carried out by dragging method. The tick population dynamic on the pasture was present during November, December, January, and March while the active population of larvae, nymph, and adult *I. ricinus* ticks in the area begins in November with a rising trend and reaches its population peak in February. The population balance of the ticks in the pasture was accompanied by increase in nymph, larvae, and adult stages of ticks respectively. However, the population of *I. ricinus* ticks on the pasture had a different pattern of larva, nymph, and adult intensity in December (Fig. 3).

**Table 1.** The tick intensity of *Ixodes ricinus* on host and on 10 m<sup>2</sup> of the pasture in different seasons

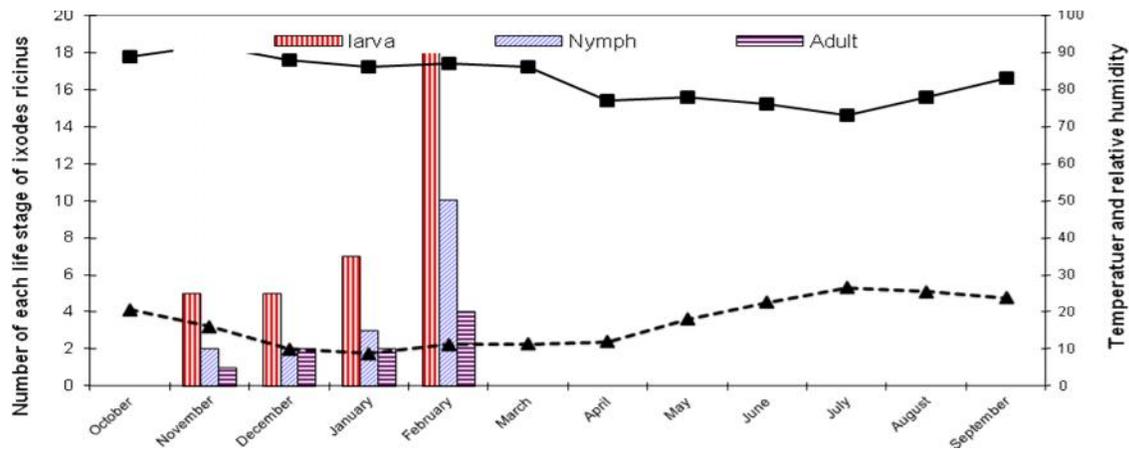
Season and Annual	Tick intensity on pasture			Tick intensity on hosts	
	Larva	Nymph	Adult	Cattle	Sheep
Fall	4	2.3	1.7	6.08	3.4
Winter	6	3.3	1.3	34.4	13.85
Spring	0	0	0	14.76	8.57
Summer	0	0	0	0	0
Annual	2.5	1.4	0.75	13.81	6.45



**Fig. 1.** The seasonal activity of Adult *Ixodes ricinus* on cattle (October 2009 to September 2010)



**Fig. 2.** The seasonal activity of adult *Ixodes ricinus* on sheep (October 2009 to September 2010)



**Fig. 3.** Tick intensity of *Ixodes ricinus* on 10 m<sup>2</sup> of the pasture (October 2009 to September 2010)

## Discussion

The studies which dealing with hard ticks in Iran so far, indicate that *I. ricinus* tick is only found in the northern provinces of Iran (Razavi et al. 2006, Rahbari et al. 2007, Razmi et al. 2007, Yossefi et al. 2008). *I. ricinus* is hence regarded a common tick species in Amol. This tick is present as the most common tick in all zoogeographical regions of the world, which have a humid climate, and especially in cold and humid weather (Kott et al. 2004). There is a wide range of hosts for this tick, which mostly feeds on cattle, sheep, horse, deer, wild rabbit, other small mammals, and birds. Since this tick is very sensitive to aridity, its behavior on plants is influenced by its need to maintain and absorb humidity from the environment (Kettle 1995).

Although Rahbari (1995) showed that the largest population of active hard ticks is found on the body of ruminants in Western Azerbaijan Province in spring and summer, it has the lowest frequency in fall. Salim abadi et al. (2008) identified that the largest population of Ixodid tick exist in Yazd Province

in summer, the results of this research indicate that the largest number of adult Ixodid ticks on each cow or sheep is found in January, February and March and no adult tick was separated from the body of the ruminants in July, August and September (Fig. 1 and 2). Therefore, we can infer from these results that the presence of adult ticks is more dependent on climatic conditions and its biological properties. These results are the same as those, which was introduced by Tuncer et al. (2004). They determined the seasonal activity of *I. ricinus* in Turkey, started in December and last until the May of the next year. Also in another work in America, Mackay and Foil (2005) found that the activity of the adult *I. scapularis* started in November and last until next May. On the other hand the researches conducted by Miroslawa (2004) in Poland, Foldvari et al. (2007) in Hungary and Hrklova et al. (2008) in Slovak, demonstrated two peaks of activity for the adult of *I. ricinus*, in spring and in summer. According to these authors, the

timing of peaks depends on many factors, such as temperature and humidity. The results of the dragging in the Amol area conformed to the results of tick intensity of animal to some extent and showed that the activity of adult *I. ricinus* tick started in November and continues until February (Fig. 3). The relative humidity was slow down from May to September, which was less than 80%. Hence, adult tick was observed neither in pasture nor on the body of the animals especially after July (Fig. 1 and 2). The rate of infestation with adult *I. ricinus* in cattle and sheep has been increased gradually during fall and reached its peak (75% in cattle and 80% in sheep) in January, February, and May. However, it started to decline with the beginning of spring and reached zero in summer times. In Western Azerbaijan, the rate of the infestation with hard ticks was 55%, 57% and 62% in sheep, goat and cattle respectively Rahbari (1995). The infestation rate with *I. ricinus* in target animals increased with the decrease in temperature and rise in humidity but decreased with the rise in temperature and decrease in humidity hence, it can be concluded that the activity of *I. ricinus* was highly dependent to the cold and humid months of the year.

The results of dragging on the pasture showed that the activity of the nymph stage of *I. ricinus* tick started in November and last until February, which showed a rising trend. This activity stopped in spring and summer (Fig. 3). In Denmark through dragging method, it was found that the nymphal stage of *I. ricinus* has a dramatic decline in its activity from May to September but slightly increased in September (Kalsbeek and Frandsen 1996). In Ireland, the nymphal stage of *I. ricinus* activity started in March and reached to zero after a slight increase. Then, it indicated a limited rise in activity from August to November (Gray 1980). Their activities showed bimodal but the comparison between these results with those achieved in Amol, re-

vealed that the main reason for this difference could be the different geographical and climatic conditions of the two regions.

The results of dragging on the pasture show that the active population of *I. ricinus* in different stages in the target area has a maximum activity curve during the year (Fig. 3). In other words, it has a unimodal activity. The larval stage of *I. ricinus* has been activated during a period from November until February, this activity stopped in spring and summer, which seems to be due to the biological properties of *I. ricinus* whose activity decreases and even stopped in the hot and dry months of the year. Gray (1985) determined the activity of the larval stage of *I. ricinus* in Ireland showed bimodal activity. The comparison of our result and those achieved in Ireland showed a difference in the monthly activity period.

It can be concluded that the activity of *I. ricinus* in Mazandaran is limited to the cold seasons of the year, this condition caused enough coldness, and humidity (over 80%) for tick host finding in fall and winter, therefore, the wide and extensive occurrence of *I. ricinus* could be observed on animals.

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