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RESEARCH ARTICLE

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Studies on Tick (*Ixodoidea*) Infestation in Sheep, Goats and Cattle in Afyonkarahisar Region[#]

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ABSTRACT

This study was carried out between May 2008 and April 2010 in the provinces of Şuhut, Iscehisar, Ihsaniye and Hocalar in order to determine the prevalence and seasonal activities of tick species in sheep, goat and cattle in Afyonkarahisar region. During the study, 1920 sheep, 1920 goats and 1920 cattle were examined for tick and developmental stages. 669 (34.84%) of the cows, 608 (31.66%) of the goats and 348 (18.12%) of the cattle were infested with different species of ticks. In Afyonkarahisar, tick infestation was determined as 28.21% in sheep, goat and cattle. During the study, 13660 ticks were collected from sheep, goats and cattle in Afyonkarahisar region. These were *Rhipicephalus bursa* (29.96 %), *R. sanguineus* (17.23 %), *Haemaphysalis parva* (16.88 %), *Dermacentor niveus* (15.09 %), *R. turanicus* (6.43 %), *Hyalomma marginatum* (4.93 %), *Hae. sulcata* (2.92 %), *Hae. punctata* (1.71 %), *D. marginatus* (0.46 %), *H. detritum* (0.2 %), *H. anatolicum* (0.09 %), *H. excavatum* (0.06 %), *Ornithodoros lahorensis* (2.35 %), *Ornithodoros spp.* nymph (1.09 %), *Ornithodoros spp.* larvae (0.05 %), *Rhipicephalus spp.* nymph (0.31 %), *Rhipicephalus spp.* larvae (0.04 %), *Haemaphysalis spp.* nymph (0.20 %) respectively.
Keywords: Afyonkarahisar, Sheep, Goats, Cattle, Tick.

Afyonkarahisar Yöresindeki Koyun, Keçi ve Sığırlarda Kene (*Ixodoidea*) İnfestasyonu Üzerine Araştırmalar

ÖZ

Bu çalışma, Mayıs 2008-Nisan 2010 tarihleri arasında, Afyonkarahisar yöresindeki koyun, keçi ve sığırlarda bulunan kene türlerinin yaygınlıklarını ve mevsimsel aktivitelerini belirlemek amacıyla Şuhut, İscehisar, İhsaniye ve Hocalar ilçelerinde yürütülmüştür. Çalışma süresince 1920 koyun, 1920 keçi ve 1920 sığır keneler ve gelişim dönemleri yönünden muayene edilmiştir. Koyunların 669 (% 34.84)'u, keçilerin 608 (% 31.66)'i, sığırların 348 (% 18.12)'i farklı kene türleri ile infeste bulunmuştur. Afyonkarahisar'daki koyun, keçi ve sığırlarda kene infestasyonu % 28.21 olarak belirlenmiştir. Koyun, keçi ve sığırlar üzerinden 13660 kene toplanmış, bunların % 29.96'sı *Rhipicephalus bursa*, % 17.23'ü *R. sanguineus*, % 16.88'i *Haemaphysalis parva*, % 15.09'u *Dermacentor niveus*, % 6.43'ü *R. turanicus*, % 4.93'ü *Hyalomma marginatum*, % 2.92'si *Hae. sulcata*, % 2.35'i *Ornithodoros lahorensis*, % 1.71'i *Hae. punctata*, % 0.46'sı *D. marginatus*, % 0.31'i *Rhipicephalus spp.* nimf, % 0.20'si *H. detritum*, % 0.20'si *Haemaphysalis spp.* nimfi, % 0.09'u *H. anatolicum*, % 0.06'sı *H. excavatum*, % 0.04'ü *Rhipicephalus spp.* larva, % 1.09'u *Ornithodoros spp.* nimf, % 0.05'i *Ornithodoros spp. larva*, olarak teşhis edilmiştir.
Anahtar Kelimeler: Afyonkarahisar, Koyun, Keçi, Sığır, Kene.

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INTRODUCTION

Ticks are one of the most important ectoparasites that threaten animal and human health by either sucking blood themselves or as a mechanical or biological carrier of many viral, bacterial, rickettsial, spiroketal, protozoa and helminth disease agents, both in the tropical and subtropical climates (Uilenberg, 1995; Karaer et al., 1997; Jongejan and Uilenberg, 2004; Byford and Craig, 2007; Dantas-Torres, 2008, İnci et al., 2016). In the world, a total of 907 tick species have been reported from Ixodidae (720), Argasidae (186) and Nuttalliellidae (1) families (Horak et al., 2002; Barker and Murrel, 2004, Dumanli et al., 2012). Turkey is a country where ticks can dwell in and continue their biological activities thanks to the climate, topography and vegetation (Karaer et al., 1997, İnci et al., 2016). This study was carried out to determine the distribution of tick species and their seasonal activities in the sheep, goats and cattle in Afyonkarahisar region.

MATERIAL and METHOD

This study was carried out between May 2008 and April 2010 in Suhut, Iscehisar, Ihsaniye and Hocalar districts of Afyonkarahisar where the vegetation, land structure, temperature, precipitation and humidity show differences and the the animal population is dense. During the course of the study, each research unit was regularly visited once a month for 24 months. In this research centers, tick species were investigated in cattle, sheep, goats and their shelters. In all districts, pasture grazing and untreated flocks of all host species were examined for ticks. The number of animals examined was determined as 20 pieces from each destination and animal species. The ticks collected from animals were seperatedly placed in tubes with perforated lids. The information such as the district from which the ticks were collected, date and host species was written on the tubes. Besides, white sheets were circulated across the pastures to collect ticks in different developmental stages. The ectoparasites collected in this way were taken in small bottles containing 70% alcohol. The ticks collected in accordance with the technique and brought in to the laboratory alive were cleaned out with thin bristles. Fed nymphs were taken in incubation (28 °C and 95% relative humidity) to molt in order to be able to diagnose the species in hungry mature condition. Under stereomicroscope, nymphs and larvae not having molted were diagnosed on the basis of family while adults were classified on the basis of species according to the keys provided by Kurtpınar (1954), Merdivenci (1969), Karaer et al. (1997), and Estrada-Pena et al. (2004). Mean precipitation, relative humidity and temperature data of Afyonkarahisar were obtained from the General Directorate of Meteorology. The evaluation of the field data was done using frequency, percentage distribution and correlation analysis in SPSS package program. Ethics committee approval was not obtained because the study material was formed by ticks.

FINDINGS

In the study, 1920 sheep, 1920 goats and 1920 cattle were tested for tick infestation. 669 (34.84 %) of sheep, 608 (31.66 %) of goats, 348 (18.12 %) of cattle were found to be infested with ticks.

The rates of tick infestation diagnosed in sheep, goats and cattle according to seasons during the study have been given in Table 1. During the two-year study period, the animals with the highest infestation rate were identified as sheep, goats and cattle, respectively. In animals, infestation was most commonly seen during the summer and at least during the winter months. It was observed that in the spring season, the animals were more infested than the autumn and less than the summer months. On a seasonal scale, the highest infestation in animals was seen in summer, spring, autumn and winter, respectively.

Table 1. Infestation rates of various ticks in sheep, goats and cattle in Afyonkarahisar region

Seasons	Infestation Rate (%)			
	Sheep	Goat	Cattle	Total
Autumn	37,29 (179/480)*	33,75 (162/480)	19,16 (92/480)	30,06(433/1440)
Winter	19,16 (92/480)	20 (96/480)	5,8 (28/480)	15(216/1440)
Spring	36,16 (188/480)	34,79 (167/480)	23,54 (113/480)	32,5(468/1440)
Summer	43,75 (210/480)	38,12 (183/480)	23,95 (115/480)	35,2(508/1440)
Mean	34,84 (669/1920)	31,66 (608/1920)	18,12 (348/1920)	28,21(1625/5760)

*The number of infested animals/ The number of examined animals

In Afyonkarahisar region 13 tick species residing five families of sheep, goat and cattle were detected. 11 species in the sheep and cattle and 10 species in goats were found. From the collected ticks, *Rhipicephalus bursa, R. sanguineus, R. turanicus,*

Hyalomma marginatum, H. detritum, Dermacentor niveus, D. marginatus and *Haemaphysalis parva Hae. punctata* were found in three animal species. Adults, larvae and nymphs of *Ornithodoros lahorensis* were only seen in the sheep, the species of *H. excavatum* and *H. anatolicum* were detected only in the cattle, and the nymph of *Haemaphysalis spp.* were observed only in the goats. The nymphs of *Hae. sulcata* and *Rhipicephalus spp.* were observed in the sheep and goats. In the grazing areas, mature *D. niveus* was found only in Hocalar while *O. lahorensis* was observed in sheep barn in Iscehisar.

The distribution of ticks collected from the sheep for two years according to research centers was shown in Table 2. During the study, 7347 tick species were collected from the sheep. The rates of these were as 25.21% *R. bursa*, 20.7% *R. sanguineus*, 20.35% *Hae. parva*, 12.58% *D. niveus*, 9.77% *R. turanicus*, 3.04% *Hae. sulcata*, 1.31% *Hae. punctata*, 0.38% *D. marginatus*, 0.15% *H. marginatum*, 0.03% *H. detritum*, 4.36% *O. lahorensis*, 0.01% *Rhipicephalus spp.* nymph, 2.03% *Ornithodoros spp.* nymph, 0.1% *Ornithodoros spp.* larvae.

Table 2. The distribution of ticks collected from the sheep according to the research centers

		Research Center					
Tick Species		Suhut	Iscehisar	Ihsaniye	Hocalar	Total	%
R. bursa	Male	162	211	509	137	1019	13,87
	Female	136	140	443	114	833	11,34
R. sanguineus	Male	48	87	653	215	1003	13,65
	Female	56	58	297	106	517	7,04
R. turanicus	Male	15	91	251	94	451	6,14
	Female	13	84	111	59	267	3,63
H. marginatum	Male	0	5	4	1	10	0,14
	Female	1	0	0	0	1	0,01
H. detritum	Male	2	0	0	0	2	0,03
	Female	0	0	0	0	0	0,00
D. niveus	Male	215	124	87	118	544	7,40
	Female	153	78	84	65	380	5,17
D. marginatus	Male	9	5	1	4	19	0,26
	Female	6	2	1	0	9	0,12
Hae. parva	Male	496	270	71	111	948	12,90
	Female	286	142	34	85	547	7,45
Hae. sulcata	Male	77	4	20	6	107	1,46
	Female	81	4	28	3	116	1,58
Hae. punctata	Male	29	19	4	10	62	0,84
	Female	14	15	2	3	34	0,46
Rhipicephalus spp.	Nymph	0	0	1	0	1	0,01
Ornithodoros lahorensis	Male	0	245	0	0	245	3,33
	Female	0	76	0	0	76	1,03
Ornithodoros spp.	Larvae	0	7	0	0	7	0,10
	Nymph	0	149	0	0	149	2,03
Total		1799	1816	2601	1131	7347	100

The distribution of the ticks collected from the sheep according to the months was given in Table 3. According to that, the highest number of ticks on the sheep was found in May, followed by June and April. The infestation was at least in August. During the course of two years of study, the tick species causing the most infestation in the sheep was *Rhipicephalus bursa* while *Hyalomma detritum* was the rarest. The ticks from *Rhipicephalus spp.* and *Hyalomma spp.* families were observed in spring and summer times (April-August) while the ticks from *Dermacentor spp.* and *Haemaphysalis spp.* families, being present mostly in autumn and winter times (September- February), reduced in number in spring and totally disappeared in summer months. Mature *Ornithodoros lahorensis* and larvae and nymphs of *Ornithodoros spp.* were encountered in November and January.

Table 3. The distribution of the ticks collected from the sheep according to the months

	Months												
Tick Species	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	Total
R. bursa	637	566	76	16	6	0	0	0	0	0	0	551	1852
R. sanguineus	505	645	172	24	0	0	0	0	0	0	0	174	1520
R. turanicus	277	204	34	5	0	0	0	0	0	0	0	198	718
H. marginatum	5	6	0	0	0	0	0	0	0	0	0	0	11
H. detritum	2	0	0	0	0	0	0	0	0	0	0	0	2
D. niveus	9	0	0	0	441	115	80	78	101	46	37	17	924
D. marginatus	1	0	0	0	8	1	5	2	1	1	6	3	28
Hae. parva	4	0	0	0	305	288	260	178	278	97	65	20	1495
Hae. sulcata	1	0	0	0	99	81	14	17	5	3	3	0	223
Hae. punctata	0	0	0	0	10	27	24	13	21	0	1	0	96
Ornithodoros lahorensis	0	0	0	0	0	0	186	0	135	0	0	0	321
Ornithodoros spp. larvae	0	0	0	0	0	0	7	0	0	0	0	0	7
Ornithodoros spp. nymph	0	0	0	0	0	0	111	0	38	0	0	0	149
Rhipicephalus spp. nymph	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	1441	1422	282	45	869	512	687	288	579	147	112	963	7347

The distribution of the ticks collected from the goats for two years according to the research centers were given in Table 4. During the course of the study, 4094 tick species were collected from the goats. The rates of these were as 44.14% *R. bursa*, 20.86% *D. niveus*, 15.12% *Hae. parva*, 5.62% *R. sanguineus*, 4.3% *Hae. sulcata*, 3.27 % *Hae. punctata*, 2.52 % *R. turanicus*, 1.89 % *H. marginatum*, 0.46 % *D. marginatus*, 0.02 % *H. detritum*, 1% *Rhipicephalus spp.* nymph, 0.68 % *Haemaphysalis spp.* nymph, 0.12 % *Rhipicephalus spp.* larvae.

Table 4. The distribution of the ticks collected from the goats for two years according to the research centers

		Research Center					
Tick Species		Suhut	Iscehisar	Ihsaniye	Hocalar	Total	%
R. bursa	Male	226	353	555	48	1182	28,87
	Female	118	236	233	38	625	15,27
R. sanguineus	Male	16	15	87	22	140	3,42
	Female	11	6	54	19	90	2,20
R. turanicus	Male	12	19	13	16	60	1,47
	Female	6	17	9	11	43	1,05
H. marginatum	Male	15	15	8	13	51	1,25
	Female	5	10	6	5	26	0,64
H. detritum	Male	0	0	0	1	1	0,02
	Female	0	0	0	0	0	0,00
D. niveus	Male	130	75	95	260	560	13,68
	Female	117	55	55	67	294	7,18
D. marginatus	Male	6	2	0	8	16	0,39
	Female	0	1	0	2	3	0,07
Hae. parva	Male	132	79	56	88	355	8,67
	Female	100	52	46	66	264	6,45
Hae. sulcata	Male	44	8	21	30	103	2,52
	Female	24	17	16	16	73	1,78
Hae. punctata	Male	20	29	7	35	91	2,22
	Female	12	14	3	14	43	1,05
Rhipicephalus spp.	Larvae	0	5	0	0	5	0,12
	Nymph	0	41	0	0	41	1,00
Haemaphysalis spp.	Nymph	0	0	0	28	28	0,68
Total		994	1049	1264	787	4094	100

The distribution of the ticks collected from the goats for two years according to the months were given in Table 5. According to that, the highest number of ticks on goats was found in June followed by September and April. The least of infestation was found in August. During the two years of the study, the tick species causing the highest and lowest rate of infestation were *Rhipicephalus bursa* and *Hyalomma detritum*, respectively. The nymphs and larvae of *Rhipicephalus spp.* were seen in November. The nymphs of *Haemaphysalis spp.* were seen only in the goats and in October.

Table 5. The distribution of the ticks collected from the goats from Afyonkarahisar region according to the months

	Months												
Tick Species	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	Total
R. bursa	325	945	250	24	4	0	3	0	0	0	0	256	1807
R. sanguineus	1	70	31	0	0	0	0	0	0	0	0	128	230
R. turanicus	10	9	27	6	0	0	0	0	0	0	0	51	103
H. marginatum	18	6	5	0	2	0	0	0	0	0	0	46	77
H. detritum	0	1	0	0	0	0	0	0	0	0	0	0	1
D. niveus	12	0	0	0	451	203	74	24	18	20	43	9	854
D. marginatus	2	0	0	0	1	5	1	0	2	2	5	1	19
Hae. parva	0	0	0	0	158	212	91	61	35	28	14	20	619
Hae. sulcata	0	0	0	0	36	23	69	17	12	4	6	9	176
Hae. punctata	0	0	0	0	8	6	69	28	6	6	8	3	134
Rhipicephalus spp. larvae	0	0	0	0	0	0	5	0	0	0	0	0	5
Rhipicephalus spp. nymph	0	0	0	0	0	0	41	0	0	0	0	0	41
Haemaphysalis spp. nymph	0	0	0	0	0	28	0	0	0	0	0	0	28
Total	368	1031	313	30	660	477	353	130	73	60	76	523	4094

The distribution of the ticks collected from the cattle from Afyonkarahisar region during the two years of study according to the research centers was shown in Table 6. During the study, 2219 tick species were collected. The rates of these were as 27.17% *R. sanguineus*, 26.36% *H. marginatum*, 19.51% *R. bursa*, 12.76% *D. niveus*, 8.65% *Hae. parva*, 2.61% *R. turanicus*, 1.13% *H. detritum*, 0.72% *D. marginatus*, 0.54 % *H. anatolicum*, 0.37% *H. excavatum*, 0.18% *Hae. punctata.*

Table 6. The distribution of the ticks collected from the cattle from Afyonkarahisar region according to the research centers

		Research Center					
Tick Species		Suhut	Iscehisar	Ihsaniye	Hocalar	Total	%
R. bursa	Male	14	58	51	21	144	6,49
	Female	18	52	42	177	289	13,02
R. sanguineus	Male	7	7	94	208	316	14,24
	Female	4	9	95	179	287	12,93
R. turanicus	Male	0	22	14	0	36	1,62
	Female	0	19	2	1	22	0,99
H. marginatum	Male	128	49	89	108	374	16,85
	Female	57	41	51	62	211	9,51
H. detritum	Male	7	2	5	3	17	0,77
	Female	2	2	3	1	8	0,36
H. excavatum	Male	6	0	1	0	7	0,32
	Female	0	0	1	0	1	0,05
H. anatolicum	Male	0	2	2	2	6	0,27
	Female	0	2	4	0	6	0,27
D. niveus	Male	52	29	29	51	161	7,26
	Female	49	31	20	22	122	5,50
D. marginatus	Male	4	0	2	4	10	0,45
	Female	4	0	2	0	6	0,27
Hae. parva	Male	10	46	13	75	144	6,49
	Female	11	31	4	2	48	2,16
Hae. punctata	Male	0	2	0	0	2	0,09
	Female	0	2	0	0	2	0,09
Total		373	406	524	916	2219	100

The distribution of the ticks collected from the cattle during the two years of study according to the months was shown in Table 7. The highest frequency of ticks on the cattle was seen in May, followed by June and April. While no tick was encountered in March, minimal infestation was detected in January. During the two years of research, the most infestation in cattle was caused by *Rhipicephalus sanguineus* and *H. marginatum* whereas *Hae. punctata* was the least prominent species.

Table 7. The distribution of the ticks collected from the cattle from Afyonkarahisar region according to months

	Months												
Tick Species	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	Total
R. bursa	263	54	8	5	0	0	0	0	0	0	0	103	433
R. sanguineus	331	230	5	0	0	0	0	0	0	0	0	37	603
R. turanicus	1	9	0	0	0	0	0	0	0	0	0	48	58
H. marginatum	207	266	39	9	17	1	0	0	0	1	0	45	585
H. detritum	6	3	0	2	0	0	0	0	0	0	0	14	25
H. excavatum	8	0	0	0	0	0	0	0	0	0	0	0	8
H. anatolicum	4	4	0	4	0	0	0	0	0	0	0	0	12
D. niveus	0	0	0	0	109	109	41	4	4	13	0	3	283
D. marginatus	0	0	2	0	9	2	2	0	1	0	0	0	16
Hae. parva	0	0	0	0	12	31	39	81	4	18	0	7	192
Hae. punctata	0	0	0	0	0	0	4	0	0	0	0	0	4
Total	820	566	54	20	147	143	86	85	9	32	0	257	2219

During the research, the distribution of the ticks on the host body parts was also determined. According to that, the mature ones of *Rhipicephalus bursa*, *R. sanguineus* and *R. turanicus* were detected in the ears of the sheep, inguinal regions of the cattle more frequently than in the other parts. The mature ones of *R. bursa* were more in perianal regions and the mature ones of *R. sanguineus* and *R. turanicus* were in the ears of the goats. Larvae and nymphs of *Rhipicephalus spp.* were on the backs of the sheep and goats. Mature *Hyalomma marginatum* was more frequently in the inguinal regions of the sheep, in inguinal and perianal regions of the cattle and goats, and also the mature *H. detritum*, *H. excavatum* and *H. anatolicum* were mostly in the inguinal regions of the cattle. Mature ones of *Dermacentor niveus* were more commonly seen in the chests of goats and tails of the sheep and cattle. Mature ones of *Dermacentor marginatus* were more frequently seen in the tails and chests of goats and in the tails of the sheep and cattle than any other parts. The mature ones of *Haemaphysalis parva* were detected in the ears of the cattle and the chests of the sheep and goats. The mature ones of *Hae. sulcata* and *Hae. punctata* were seen more in the chests of the sheep and goats thn in the other parts. The nymphs of *Haemaphysalis spp.* were detected on the backs of the goats. The mature ones of *Ornithodoros lahorensis* and the larvae and nymphs of *Ornithodoros spp.* were observed on the backs of the sheep.

In the research, a significant linear relationship was not found between the numbers of *R. bursa*, *R. sanguineus*, *R. turanicus*, *Rhipicephalus spp.* nymph, *H. marginatum*, *H. detritum*, *H. excavatum*, *D. marginatus*, *D. niveus*, *Hae. sulcata*, *Haemaphysalis spp.* larvae and nymph, *O. lahorensis*, *Ornithodoros spp.* larvae and nymph and mean precipitation, mean temperatures and mean humidity measures ($p>0.05$). A negative relation was determined between the numbers of mature *Hyalomma anatolicum* and mean humidity measures ($p\leq0.05$). As the humidity increased, the number of *H. anatolicum* decreased. A significant linear relation was not found between the numbers of mature *Hyalomma anatolicum* and mean precipitation and temperature measures ($p>0.05$). A positive relation was determined between the numbers of the mature *Haemaphysalis parva* and mean humidity measures ($p\leq0.05$). As the humidity increased, the number of the mature *Hae. parva* increased. A significant linear relationship was not found between mean precipitation and mean temperature measures and the number of mature *Hae. parva* ($p>0.05$). A positive relationship was determined between the number of mature *Haemaphysalis punctata* and mean humidity measures ($p\leq0.05$). As the mean humidity rose, the number of mature *Hae. punctata* increased. A significant linear relationship was not determined between the mean precipitation and mean temperature measures and the number of the mature ones of the species ($p>0.05$).

DISCUSSION

In the studies conducted in Turkey to date, 32 tick species have been determined in the sheep, goats, and cattle (Kurtpınar 1954; Oytun, 1956; Merdivenci, 1969; Aydın and Bakırcı, 2007; Dumanlı et al., 2012). In this study conducted in Afyonkarahisar, 13 species such as *Rhipicephalus bursa*, *R. sanguineus*, *R. turanicus*, *Hyalomma marginatum*, *H. detritum*, *H. anatolicum*, *H. excavatum*, *Dermacentor niveus*, *D. marginatus*, *Haemaphysalis parva*, *Hae. punctata*, *Hae. sulcata* and *Ornithodoros lahorensis* were found in the sheep, goats, and cattle.

In the study, *Rhipicephalus bursa* was found in all research centers. When listed according to the frequency rates in the animal species, it was mostly seen in the sheep, goats and the cattle, respectively. It was maximal in April-June and minimal in July-August. This is compatible with the findings of other studies (Karaer, 1983; Zeybek and Kalkan, 1984; Taşçı, 1989; Arslan et al., 1999; Aktaş et al., 2006; Mamak et al., 2006; İça and Özkan, 2015). Compared to the other *Rhipicephalus* species, it is the most frequently encountered species. While this is similar to the findings of some studies (Sayın and Dumanlı, 1982; Taşçı, 1989; Aydın, 1994; Razmi et al., 2007), also presents differences with some others (Yukarı and Umur, 2002; İça and Özkan, 2015).

The ticks of *Rhipicephalus sanguineus* species were observed in all research centers. It was seen in April-August in the sheep and in April-July in the cattle and goats. When all research centers were considered, it was mostly seen in June and minimally in July. This is compatible with other previous studies (Taşçı, 1989; Beyazıt, 2000).

Rhipicephalus turanicus was most frequently collected from the sheep and most densely in May. The least number was collected from the cattle. It was most densely collected from the cattle and goats in April. While this species among *Rhipicephalus* species was reported to be the most dominant in Burdur (Yukarı and Umur, 2002), Kütahya (İça and Özkan, 2015), Van Region (Taşçı, 1989) and Black Sea Region (Aydın et al., 2012), it was the least detected species in our study.

Species from *Hyalomma* family were most and least commonly seen in the cattle and in the sheep, respectively. When listed according to density, *H. marginatum*, *H. detritum* and *H. anatolicum* and *H. excavatum* species of ticks were diagnosed. It was reported that the ticks from that family were observed on the cattle in Manisa, İzmir and Aydın provinces throughout the year but their numbers were limited during the winter months (Bakırcı et al., 2012). During the research, the ticks from that family were observed between April and July and most commonly seen in June.

The ticks from *Dermacentor* family were mostly reported in goats and minimally observed in the cattle in Burdur region (Yukarı and Umur, 2002). In the study carried out in Kütahya region (İça and Özkan, 2015), *D. marginatus* was reported to have been commonly seen only in the sheep. In our study, *Dermacentor niveus* and *D. marginatus* were seen in all animal species, mostly in the sheep and minimally in the cattle, frequently in autumn months.

In our study, from *Haemaphysalis* family, *Haemaphysalis parva, Hae. sulcata* and *Hae. punctata* species were observed. When three species were compared, mostly *Hae. parva* and minimally *Hae. punctata* were detected. All three species were observed between September and April. It was reported to have been seen in the sheep and goats in Samsun region in August, September, November and December (Zeybek, 1980). It was reported that all three species were observed in the Northern Marmara Region, Balıkesir, Bilecik, Bursa and Çanakkale provinces during autumn and winter months (Aydın, 2002). In our study, in the cattle, *Hae. parva* and a small number of *Hae. punctata* were detected. *Haemaphysalis* species were reported to be on the animals in Van and Gevaş, Muradiye, Erciş, Özalp and Saray districts during autumn, winter and spring times (Akdemir, 2001). The data on these species derived from our study are compatible with the results of that study. It was reported that in Ankara region, *Hae. parva* and *Hae. punctata* were intensely observed on the cattle, sheep and goats in March and October while *Hae. sulcata* were at high levels in March and November (Cicek, 2004). In our study, ticks of *Hae. sulcata* were not found on the cattle.

In the study conducted on the cattle and sheep in Kayseri region it was reported that ticks of *Ornithodoros lahorensis* species were only seen in the sheep (Yay et al., 2004), encountered in the cattle and sheep in Elazığ (Sayın and Dumanlı, 1982), and were not found in the Northern Marmara Region (Aydın, 1992). During the research, the ticks of *O. lahorensis* were detected only in the sheep in November and January. They were not found in other animal species.

Ixodes ricinus, Ixodes hexagonus species from Ixodes family were reported in Turkey. *I. ricinus* was mostly reported in the forestland and coastal regions (Gargılı et al., 2010). In addition, previous studies

have reported that such species are more frequent in high regions with low altitude and relative intensity (Er, 1996). İça and Özkan (2015) reported that they found these two tick species in high altitude forestland in Kütahya region. In this study, no ticks from that family was found in any animal species.

Boophilus (*Rhipicephalus*) *annulatus* has been reported to reside on animals mostly in spring and autumn months (Hoofman et al., 1971). It has been reported to appear in the cattle in Burdur region in the months other than February, March, and August (Yukarı and Umur, 2002), in the cattle and sheep in Elazığ region mostly in spring (Sayın and Dumanlı, 1982), that it is the most frequent species in the cattle in the Northern Marmara region and the least frequent one in sheep and goats (Aydın, 1994), that it is seen in the cattle more commonly than in the sheep and goats in Kütahya region (İça and Özkan, 2015). During our research, *Boophilus* (*Rhipicephalus*) *annulatus* was not seen in any animal species. It has been considered that the insecticide regularly applied to the cattle within the scope of the combat put up against ticks by the Ministry of Food, Agriculture and Livestock during the years of the study, and that this species is overly susceptible to the cold weather might have resulted in not encountering this species.

RESULT

In Afyonkarahisar region, 13 tick species such as *Rhipicephalus bursa*, *R. sanguineus*, *R. turanicus*, *Haemaphysalis parva*, *Hae. sulcata*, *Hae. punctata*, *Dermacentor niveus*, *D. marginatus*, *Hyalomma marginatum*, *H. detritum*, *H. anatolicum*, *H. excavatum*, *Ornithodoros lahorensis* were collected from the sheep, goats and cattle. The mature ones of *Rhipicephalus bursa* were extensively detected in areas where the terrestrial climate is dominant, with steppe vegetation and calcareous soil structure. The occurance of *Rhipicephalus sanguineus* were more common in the regions where the Mediterrannean climate is dominant and covered with scrubs and rugged terrain. Mature *Rhipicephalus turanicus* was seen in the areas where vegetation is richer in steppe and forestland. The mature ones of *Hyalomma marginatum* were commonly seen in the regions covered with scrubs where the terrestrial climate is dominant, and the mature ones of *H. detritum* and *H. excavatum* were extensively present in the regions with the terrestrial climate. Mature ones of *Dermacentor niveus* and *D. marginatus* were most commonly observed in high altitude regions with rich scrubs and forestland. The mature ones of *Haemaphysalis parva* and *H. sulcata* were more frequently observed in the high altitude regions where the vegetation is poor but the terrestrial clime is softer. In the study, the mature ones of *Haemaphysalis punctata* were less frequently found in the regions with steppes than other *Haemaphysalis* species.

In Afyonkarahisar region, tick infestation was highest in sheep (34.84%), in goats (31.66%) and in cattle (18.12%), respectively. *Hameaphysalis spp.* nymph and larvae were found in goats, *Rhipicephalus spp.* nymphs were found in the sheep and goats, and larvae were only found in the goats during the study. In order for an effective combat against the ticks, the seasonal activities of the species must be known. Therefore, the seasonal activities of ticks in all regions must be determined.

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