PREVALENCE OF CATTLE TICK INFESTATION IN THREE DISTRICTS OF THE PUNJAB, PAKISTAN

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ABSTRACT: A survey was conducted to evaluate the current precipitation of cattle tick infestations in the livestock progressive districts of Punjab including Sargodha, Khushab and Rawalpindi. The tick species identified from cattle were *Hyalomma anatolicum anatolicum, Rhipicephalus (Boophilus) microplus, Rhipicephalus sanguineus, Rhipicephalus (Boophilus) annulatus* and *Haemaphysalis* spp. The overall prevalence of cattle tick infestation was 54.76%. The highest prevalence (57.71%) of cattle tick infestation was recorded in Sargodha district followed by Khushab (54.00%) and Rawalpindi (52.57%) districts, respectively. Breed, age and month-wise prevalence of tick infestation was statistically significant ($P<0.05$). Highest prevalence of tick infestation was recorded in the months of June-July in all study districts. The analysis of simple linear regression revealed that mean maximum temperature was significantly involved on month-wise prevalence of ticks in all study regions. Perineum, udder and external genitalia (98%) were the most tick infested sites in cattle followed by dewlap (92%), inner thighs (90%), neck & back (54%), tail (26%), ears (13%), around eyes (10%), flanks (4%) and legs (2%).

Key words: Prevalence, cattle, tick infestation, Punjab.

INTRODUCTION

Ticks are the most important ectoparasites of cattle. They are responsible for reduce production, infertility, diseases and death (Rajput *et al*. 2006). Ticks are blood suckers, damage skins, hides, intoxicate and predispose cattle to dermatophilosis and myiasis (Gates and Wescott, 2000; Mtshali *et al*., 2004). Ticks are the important vectors of tick-borne diseases (TBDs) like anaplasmosis, babesiosis and theileriosis (Norval *et al*., 1984). Production losses due to ticks and tick-borne diseases (TTBDs) around the globe have been estimated at US$ 13.9 to US$ 18.7 billion annually leaving world's 80% cattle at risk (de Wall, 2000, de Castro, 1997 and Ghosh *et al*., 2007).

Geo-climatic condition of Punjab, Pakistan favours the multiplication and survival of ticks which play a major role in the biological transmission of TBDs. In earlier reports the prevalence of cattle tick infestation was more than 50% from Punjab (Durrani *et al*., 2008, Sajid *et al*., 2009). As far as we can search, the knowledge about the magnitude of the cattle tick infestation is extremely inadequate in Sargodha, Khushab and Rawalpindi districts of the Punjab, Pakistan. Therefore, a survey was designed to investigate the prevalence of predominant tick species infesting cattle.

MATERIALS AND METHODS

Study location: Epidemiological studies were conducted in Sargodha, Khushab and Rawalpindi districts of the Punjab, Pakistan. Sargodha district is situated between 32° 10' north latitudes and 72° 40' east longitude with an average temperature ranging from 25-49 °C in summer and 5-23 °C in winter and annual rainfall of 526 millimeter. Khushab is the driest and hottest district with diverse topography, located at 32° 20' N latitude to 72° 20' E longitude. The temperature ranges from 25-48 °C in summer and 19-29 °C in winter with average annual precipitation of 521 millimeter (RRCAP, 2011). Rawalpindi district is situated at 33° 40' north latitude and 44° 30' east longitude. It receives annual average rainfall of 1364 millimeter and an average temperature range from 14.1-28.4°C (GOP, 2011).

Sampling strategy: A total of 1050 tick specimens were collected from randomly selected small holders (n=90) and private livestock farms (n=12) using multistage cluster random sampling technique (Thrusfield, 2005). All the union councils in each district were included in the sampling frame. A total of 30 union councils, 34 cattle farms (30 small holders and 4 livestock farms) and 350 animals were selected as primary, secondary and tertiary sampling units from each district. Sampling unit was indigenous and crossbred cattle of both the sexes. The criteria for the selection of small holder and private livestock farms were: (a) number of cattle per small holder 1-10 (b) number of cattle per livestock farm ≥50

(c) no history of acaricide application/administration for the last 90 days. Moreover, different body parts were examined and ticks were counted to determine the intensity of tick infestation in specific body parts as mentioned by Magona *et al*. (2008).

Prevalence was estimated using formula: P= d/n × 100; where P= Prevalence, d= No. of animals found positive, n= Total no. of animals sampled (Thrusfield, 1995).

Collection, identification and processing of tick specimens: Adult hard tick specimens were collected from different body parts of cattle without damaging their mouth parts using forceps. Each specimen was placed in a separate vial containing 70% ethyl alcohol and the labeled specimens were dispatched to University College of Agriculture, University of Sargodha for identification and processing of tick specimens. The permanent mounts were prepared as described by Sajid (2007).

Morphological characters of ticks were studied and identified using stereo microscope according to the keys as mentioned by McCarthy (1967), Kaiser and Hoogstraal (1964), Walker *et al*. (2003) and Estrada-Pena *et al*. (2004).

The data regarding the prevalence of tick infestation was statistically analyzed by applying Chi square test. The month-wise prevalence and meteorological data was associated with simple linear regression using Statistical Package for Social Services (SPSS) version 13.0. A *p*-value <0.05 was considered statistically significant.

RESULTS

Out of 1050 animals, 575 cattle were tick infested. The overall prevalence was 54.76% (575/1050). The prevalence of tick species recorded from the study area was *Hyalomma (Hy.) anatolicum anatolicum* (22.86%, 240/1050), *Rhipicephalus (Boophilus) microplus* (21.33%, 224/1050), *Rhipicephalus sanguineus* (7.52%, 79/1050) and *Rhipicephalus (Boophilus) annulatus* (1.43%, 15/1050) and *Haemaphysalis* spp. (1.62%, 17/1050).

Highest prevalence of ticks was recorded in Sargodha district (57.71%, 202/350) followed by Khushab (54.00%, 189/350) and Rawalpindi district (52.57%, 184/350; Table I). The prevalence of tick infestation was non-significant among Sargodha, Khushab and Rawalpindi districts (χ^2= 1.99, df=2, P>0.05**)**. District-wise prevalence of tick species is presented in Fig. 1-3. Highest prevalence of tick infestation (71.61%; 227/317) was recorded in >5 years of age and lowest in <1 year of age (20.80%; 68/327). Chi-square value indicated a significant (*P*<0.001) association among tick infestation at different age groups. Regardless of the district under study, the higher prevalence of tick infestation was recorded in male cattle (56.46%, 153/271) as compared to female (54.17%, 422/779). However**,** the prevalence of tick infestation was non-significant (*P*>0.05) among cattle of either sex.

Higher prevalence of tick infestation was recorded in crossbred (80.31%, 412/513) as compared to indigenous cattle (30.35%, 163/537). The prevalence of tick infestation was significant (*P*<0.001) among different breeds. Irrespective of the district under study, the higher prevalence of tick infestation was recorded in small holder (58.44%, 263/450) cattle as compared to large livestock farms (52.00%, 312/600). However**,** the prevalence of tick infestation was non-significant for both farm sizes *P*>0.05).

Month-wise prevalence of tick infestation was statistically significant in all three districts (*P*<0.05). It was revealed that temperature above 27.7^{o}C and humidity ranging from 37.2-63.3% was conducive for tick population. Analysis of the simple linear regression indicated that monthly mean maximum temperature had significant association (*P*<0.001) with the month-wise prevalence of tick infestation in all study districts. On the contrary, the humidity had no significant association with any district (*P*>0.05). Highest prevalence was recorded in the month of July (96.67%) in Sargodha and Khushab districts; where as highest prevalence (93.33%) of tick infestation was noticed in the month of June in Rawalpindi district (Fig. 4).

Various body parts were examined in order to rank the predilection sites of tick infestation in cattle. It was revealed that perineum, udder and external genitalia (98%) were the most tick infested sites followed by dewlap (92%), inner thighs (90%), neck and back (54%), tail (26%), ears (13%), around eyes (10%), flanks (4%) and legs (2%) in descending order.

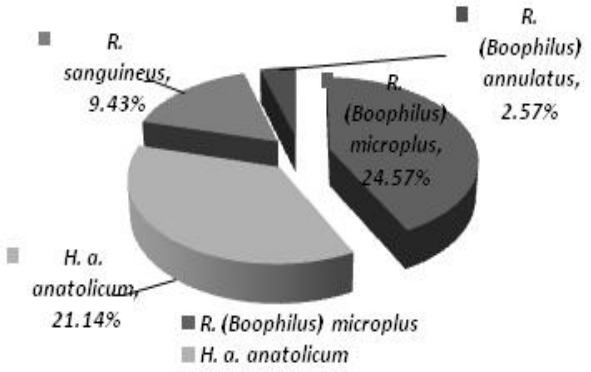

Fig. 1. Prevalence of tick species in Sargodha district.

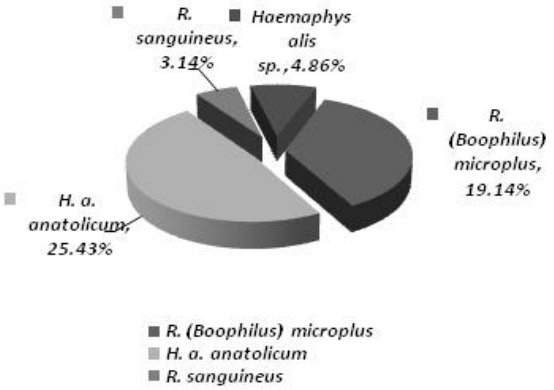

Fig. 2. Prevalence of tick species in Khushab district.

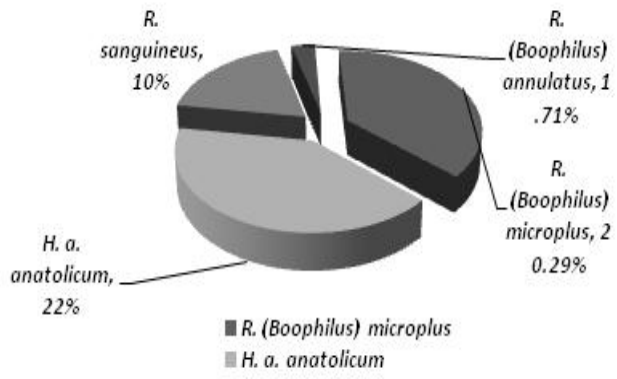

Fig. 3. Prevalence of tick species in Rawalpindi district.

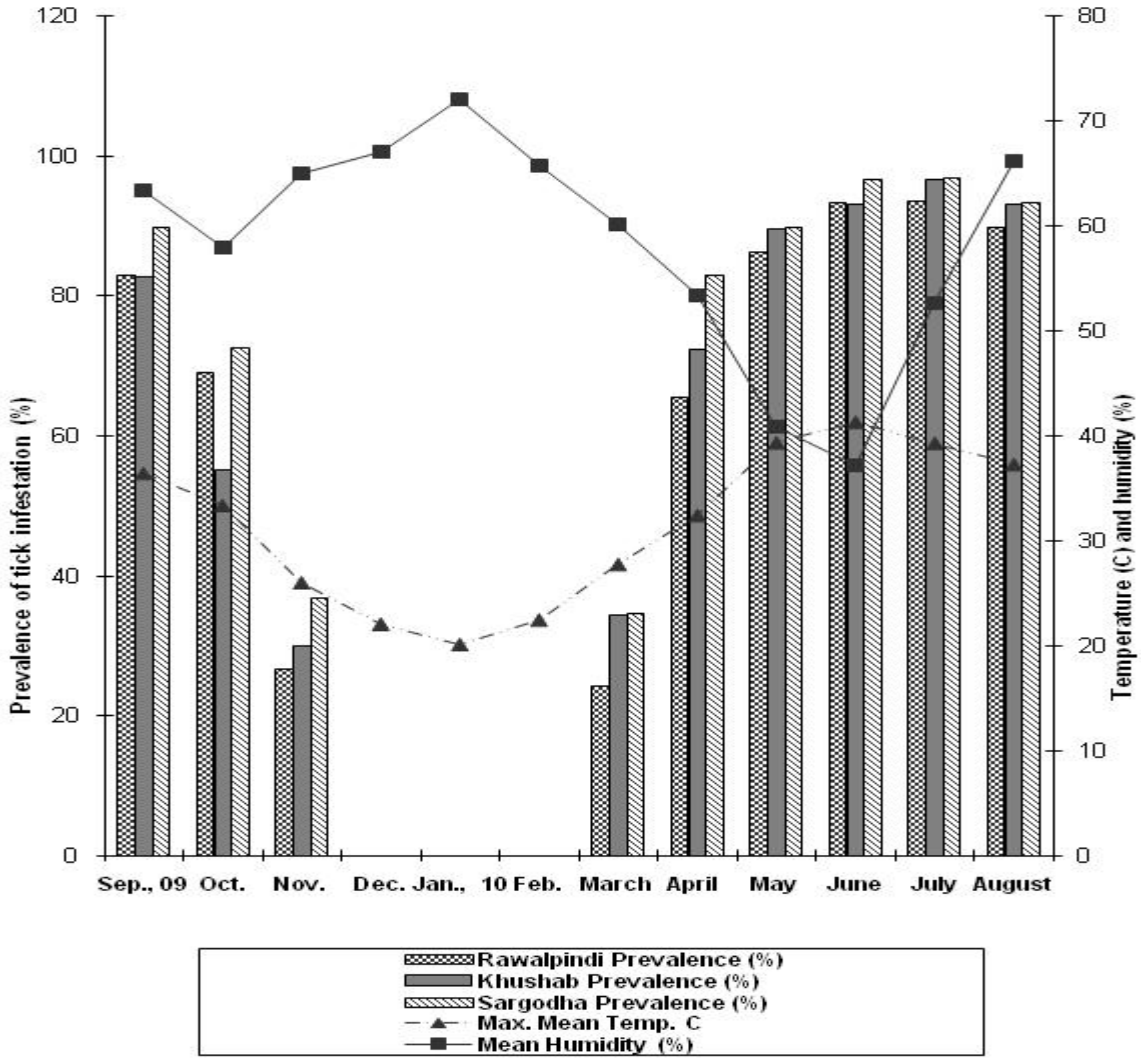

Fig. 4. Month-wise prevalence of tick infestation among cattle in Sargodha, Khushab and Rawalpindi districts, Punjab, Pakistan from September, 2009 to August, 2010.

(Sargodha, χ^2= 216.53, df=11, P<0.001; Khushab, χ^2= 200, df=11, P<0.05; Rawalpindi χ^2= 198, df=11, P<0.001).
Mean maximum Temperature (Simple linear regression, P<0.001).
Mean humidity (%) (Simple linear regression, P>0.05).

DISCUSSION

As far as we can ascertain, there was no know large scale survey on the prevalence of tick species infesting cattle from Sargodha and Khushab districts. The prevalence of cattle ticks and its species are quite comparable with Sajid *et al.* (2009) who reported *Hy. anatolicum anatolicum* and *R. sanguineus* tick species from Layyah and Muzaffargarh districts of the lower Punjab. The difference in the prevalence of ticks and occurrence of different tick species may be due to difference of area, vegetation, humidity and rain fall (Wesonga *et al*., 2006).

The results of the present study on host determinants of age and cattle breeds regarding tick infestation coincide with L'Hostis *et al.* (1996) and Swai *et al*. (2005) they depicted that tick infestation was higher in calves as compared to their elder members of young stock. Lack of immunity and softer tissues and thinner skin of young animals would help in the penetration of mouth parts for feeding (Sajid, 2007). Moreover, Sajid and associates have reported higher prevalence of tick infestation in crossbred cattle of 5-10 years of age (Sajid *et al*., 2009).

Wambura *et al*. (1998) has noticed that Zebu (*Bos indicus*) is relatively resistant to ticks as compared to *Bos indicus* and *Bos taurus* crosses. They associated the higher concentration of serum complements for tick resistance in zebu cattle. Pakistan's Sahiwal cattle is more resistant to tick infestation than European breeds (Sajid *et al*., 2009). Tick resistance is a hereditary trait in *Bos indicus* cattle (Jongejan and Ulenberg, 2004).

The highest abundance of the ticks was reported in July (Sajid, 2007), where as *Hyalomma* spp. of ticks were most abundant in June (Durrani, 2008). Ahmad and Hashmi (2007) have mentioned the highest prevalence of ticks and *Babesia bigemina* infection in cattle during the month of August in Malakand region. This area lies in the northern high land cooler region of Pakistan. In Malakand region, the spring starts in April while in plane southern regions it starts earlier in March. Durrani (2008) also associated the prevalence of *Theileria annulata* with the tick abundance in June. Marufu and associates have also reported that higher prevalence of cattle tick infestation in hot-wet season (Marufu *et al*., 2011). The other factors like area, sex and farm size had not played a significant role in the prevalence of cattle tick infestation in the study districts.

The higher prevalence of ticks was observed in Sargodha district than Rawalpindi district attributed to the fact that moderate temperatures and humidity of Sargodha district favours the growth and multiplication of vector ticks as compared to relative extreme arid environments of Khushab and Rawalpindi districts with low and high rainfall climates, respectively. Moreover, higher stall feeding trend by the livestock farmers in Sargodha district could also be the reason for higher prevalence. Lowest prevalence in Rawalpindi district is attributed to the fact that more grazing pattern have been observed in Rawalpindi district. Grazing help in lesser tick infestation and maximum tick anorectic effect (Durrani, 2008).

Predilection sites vary with host and infesting tick specie. *Boophilus decolaratus* had strong predication for head, dewlap and back while *Haylomma marginatum rafipes* prefer ano-valva area and tail (Tessema and Gashaw, 2010). Maximum no. of ticks were collected in perineum of Nguni and non-descriptive cattle in communal rangelands in South Africa (Marufu *et al*., 2011). The external genitals and inguinal/groin region of the body are highly supplied with blood. Ticks usually prefer thinner and short hair skin for infestation. This helps in easy penetration of mouth parts into richly vascular area for feeding (Sajid, 2007). It is concluded that Sargodha district's small holder crossbred cattle of more than five year of age are more susceptible to tick infestation. Highest prevalence of tick infestation was recorded in June-July. Integrated tick control along with rearing of local tick resistant breeds is recommended.

REFERENCES

Ahmad, N. and H. A. Hashmi, A comparative study on the incidence of ticks and ticks borne diseases on local and crossbred cattle in Malakand Agency. J. Anim. Pl. Sci., 17: 56-58 (2007).

de Castro, J. J., Sustainable tick and tick borne disease control in livestock improvement in developing countries. Vet. Parasitol., 71: 77-97 (1997).

de Wall, D. T., Anaplasmosis control and diagnosis in South Africa. Ann. N. Y. Acad. Sci., 916: 474-83 (2000).

Durrani, A. Z., Epidemiology, serodiagnosis and chemoprophylaxis of theileriosis in cattle. Ph.D Thesis. University of Veterinary and Animal Sciences, Lahore, pp: 96-122 (2008).

Durrani, A. Z., A. R. Shakoori and N. Kamal, Bionomics of Hyalomma ticks in three districts of Punjab, Pakistan. J. Anim. Pl. Sci., 18: 17-23 (2008).

Estrada-Pena, A., A. Bouattour, J. L. Camicas and A.R. Walker, Ticks of domestic animals in the Mediterranean region. Ist Ed, University of Zaragoza, Spain, 131-134 (2004).

Gates, N. I. and R. B. Wescott, Parasites of cattle. College of Veterinary Medicine, Washington State Univ., http://cru. cahe.wsu.edu /CEPublications/eb1742/eb1742.pdf (2000).

Ghosh, S., P. Azhahianambia and M. P. Yadav, Upcoming and future strategies of tick control: a review. J. Vect. Borne Dis., 44: 79-89 (2007).

GOP, Board of investment. Prime Minister's Secreteriate (Public), Government of Pakistan.

http://investinpakistan.pk/pdf/Land%20Availability/Punjab.pdf (2011).

Jongejan, F. and G. Uilenberg, The global importance of ticks. Parasitol., 129: S3–S14 (2004).

Kaiser, M. N. and H. Hoogstraal, The *Hyalomma* ticks of Pakistan, India and Ceylon with key to subgenera and species. Acarologia, 6: 257–286 (1964).

Khan, M. N., C.S. Hayat, Z. Iqbal, B. Hayat and A. Naseem, Prevalence of ticks on livestock in Faisalabad, Pakistan. Pak. Vet. J., 13: 182-184 (1993).

L'Hostis M., A. Bureaud and A. Gorenflot, Female *Ixodes ricinus* (Acari, Ixodidae) in cattle of Western France: infestation level and seasonality. Vet. Res., 27: 589-597 (1966).

Magona, J.W., J. Walubengo, W. Olaho-Mukani, N.N. Jonsson, S.C. Welburn and M.C. Eisler, Clinical features associated with seroconversion to *Anaplasma marginale*, *Babesia bigemina* and *Theileria parva* infections in African cattle under natural tick challenge. Vet. Parasitol., 155: 273-280 (2008).

Marufu, M. C., M. Chimonyo, C. Mapiye and K. Dzama, Ticks loads in cattle raised on sweet and sour rangelands in the low-input farming areas of South Africa. Trop. Anim. Health Prod., 43: 307-313 (2011).

Mc Carthy, V. C., Ixodid ticks (Acarina, Ixodidae) of West Pakistan. *Ph.D. Thesis*, Faculty of Graduate School of the University of Maryland, USA (1967).

Mtshali, M. S., D. T. de Wall and P. A. Mbati,. A sero-epidemiological survey of blood parasites in cattle in the north-eastern Free State, South Africa. Onderstepoort J. Vet. Res., 71: 67-75 (2004).

Norval, R. A. I., B. H. Fivaz, J. A. Lawrence and A. F. Brown, Epidemiology of tick-borne diseases of cattle in Zimbabwe. Trop. Anim. Health Prod., 16: 63-70 (1984).

Rajput, Z. I., H. U. Song-Hua, A. G. Arijo, M. Habib and M. Khalid, Comparative study of *Anaplasma* parasites in tick carrying buffaloes and cattle. J. Zhejiang Univ. Sci. B, 6: 1057-1062 (2005).

RRCAP, Regional Resource Centre for Asia and the Pacific. http://www.rrcap.unep. org/lc/cd/html/countryrep/pakistan/studyarea.html (2011).

Sajid, M. S., Epidemiology, acaricidal resistance of tick population infesting domestic ruminants. Ph.D Thesis. University of Agriculture, Faisalabad, Pakistan, pp: 47 (2007).

Sajid, M. S., Z. Iqbal, M. N. Khan, G. Muhammad and M.K. Khan, Prevalence and associated risk factors for bovine tick infestation in two districts of lower Punjab, Pakistan. Prev. Vet. Med., 92: 386-391 (2009).

Swai, E. S., A. N. Mbise, V. Kessy, E. Kaaya, P. Sanka and P.M. Loomu, Farm constraints, cattle disease perception and tick management practices in pastoral Maasai community-Ngorongoro, Tanzania. Livestock Res Rural Development, 17 (2) (2005).

Tessema, T. and A. Gashaw. Prevalence of ticks on local and crossbred cattle in and around Asella town, southeast Ethiopia. Ethiop. Vet. J., 14: 79-89 (2010).

Thrusfield, M., Veterinary epidemiology, 2nd Ed. Blackwell Science, London, UK, pp: 39-41 (1995).

Thrusfield, M., Veterinary epidemiology, 3rd Ed. Blackwell Science, London, UK, pp: 231-32 (2005).

Wambura, P. N., P.S. Gwakisa, R. S. Silayo and E. A. Rugaimukamu, Breed-associated resistance to tick infestation in *Bos indicus* and their crosses with *Bos taurus*. Vet. Parasitol., 77: 63-70 (1998).

Walker, A. R., A. Bouattour, J. L. Camicas, A. Estrada-Pena, I.G. Horak, A.A. Latif, R.G. Pegram and P.M. Preston, Ticks of Domestic Animals in Africa: A Guide to Identification of Species, Bioscience Reports, Edinburgh, UK (2003).

Wesonga, F. D., G. N. Orinda, G. O. Ngae and J. Grootenhuis, Comparative tick counts on game, cattle and sheep on a working game ranch in Kenya. Trop. Anim. Health Prod., 38: 35–42 (2006).