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Short Communication

Epizootiology of Ectoparasitic Fauna Infesting Selected Domestic Cattle Population of Punjab, Pakistan

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Abstract

A cross-sectional survey was conducted in order to determine the epizootiology of ectoparasitic fauna infesting domestic cattle population of district Toba Tek Singh (T.T. Singh), Punjab, Pakistan. A questionnaire-based surveillance of 3864 cattle respondents, randomly selected through two-stage cluster sampling was conducted over a period of one year from March, 2011 to February, 2012. A total of 822 (21.27%) subjects were found infested with ectoparasites including ticks (39.1%), mites (4.34%), lice (23.23%), fleas (0.89%) and flies (5.32%). Taxonomic studies revealed following species: *Hyalomma anatolicum* and *Rhipicephalus microplus* of ticks; *Ctenocepahlides (Ct). felis* and *Ct. canis* of fleas; *Haematopinus eurysternus, Damalinia bovis* and *Linognathus vituli* of lice; *Psoroptes bovis* and *Sarcoptes scabei* of mites; and *Stomoxys calcitrans* of flies. Friesian cattle (*Bos taurus*) was significantly more proned to infestation as compared to Jersey (*Bos taurus*), cross-bred (*Bos taurus* × *Bos indicus*) and Sahiwal (*Bos indicus*). Among various determinants, age and sex of host; feeding and animal keeping systems were not found statistically associated with the prevalence of ectoparasites ($P>0.05$). However, cemented floor was having a positive statistical association with the ectoparasites ($P<0.05$). The prevalence of fleas, lice and mites was found higher in winter, while prevalence of ticks and fly reached to their peaks in summer and spring seasons, respectively. The data corresponds to a significant chapter of domestic cattle population and can help to restrict the spread of invasion, which causes skin and hide quality squalor and disease spread in the area.

Keywords: Ectoparasites; Prevalence; Cattle; Associated risk factors

Introduction

Ectoparasites (Insecta and Arachnida) are considered as the greatest threat to livestock economy effecting approximately 80% of the cattle population worldwide (Raut *et al.,* 2008). These obligate parasites live on, puncture, or burrow into the surface of their host's epidermis, to feed or shelter (Petney *et al.,* 2007). Ectoparasites are involved in mechanical injury, anaemia, loss of condition, irritation, allergy, toxicosis, morbidity and mortality (Niyonzema and Kiltz, 1986). Indirect effects of ectoparasitism include: transmission of pathogens causing babesiosis, theileriosis, anaplasmosis etc. (Shemshad *et al.*, 2012; Alim *et al.*, 2012) and/or their potential of serving as reservoirs of certain bacteria e.g. *Pasteurella multocida, Brucella abortus* and *Salmonella typhimurium* (Kabir *et al.,* 2011). The presence of salivary and fecal antigens from burrowing ectoparasites can result in hypersensitivity reaction in some animals.

Feeding activity of the ectoparasites may result in some cases premature death (Van den Broek *et al.,* 2003; Oruc *et al.,* 2012). Ectoparasites and ectoparasites-borne infections can lead to a major impact on husbandry, productivity, animal welfare as well as micro and macroeconomics especially in the small holder dairy farming community (Colebrook and Wall, 2004; Iqbal *et al.,* 2013). In Pakistan, a few reports are available from different regions concerning prevalence of ectoparasitic infestation, taxonomy and associated determinants in cattle (Sajid *et al.*, 2008a, b). The diverse agro-climatic conditions, animal husbandry practices and pasture management largely determine the variability and severity of prevalence of ectoparasites (Sajid *et al.*, 2009), which necessitates the need of an epidemiological survey in the study district. The present study was therefore, planned to determine the frequency distribution and associated determinants of ectoparasites in a selected population of district T.T. Singh, Punjab, Pakistan.

Materials and Methods

The detailed geography, climatic conditions and seasonal variations of district T.T. Singh has been described earlier (Iqbal *et al.,* 2013). A questionnaire was prepared using closed-ended questions (dichotomous and multiple choice) refined through informal and formal surveys. Based on two-stage cluster random sampling, the numbers of primary units (union councils) and secondary units (farms) were sampled by using the formula given by Thrusfeild (2007).

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$$g = \frac{1.96^2 TsVc}{d^2 Ts - 1.96^2 Pexp\ (1 - Pexp)}$$

Union councils to be sampled were selected by using map grid method. A total of 35 union councils (UC), 350 farms having 3864 cattle were included in this survey. Cattle of <2 years of age were classified as young and >2 years as adult. The cross-sectional study was conducted fortnightly from March, 2011 to February, 2012 to collect relevant information on a predesigned questionnaire. Climatic data of district T.T. Singh was obtained from the Meteorological Department, University of Agriculture, Faisalabad (UAF), Pakistan for the given year. Ectoparasites were collected in McCartney sample collection vials containing 70% ethanol, labelled and transported to the Department of Parastiology, UAF for further processing and taxonomic identification using standard protocols (Soulsby, 1982; Walker *et al.,* 2003). The descriptive data were analyzed through multiple logistic regression and odds ratio (OR) (Thrusfield, 2007). All the analyses were carried out using SAS (2010) software package at 95% level of confidence.

Results

Over all prevalence of ectoparasites in cattle of district T.T. Singh was recorded as 21.27% (822/3864). Among ectoparasites, rate of infestation of ticks (two species), mites (two species), lice (three species), fleas (two species) and flies (one specie) were 39.1%, 4.34%, 23.23%, 0.89% and 5.32%, respectively. Comparative distribution of ectoparasites with respect to the study variables and levels has been summarized in Table 1. Within each variable the distribution has been shown in a descending order from top to bottom. Among various risk factors, age and sex were not found associated (P>0.05) with ectoparasitic infestation; however, breed susceptibility to ectoparasitic infestation was found statistically variable (P>0.05) being highest in Friesian, followed in decreasing order by Jersey, Cross-bred and Sahiwal. Seasonal tendencies of fleas, lice and mites were highest during winter months; however, those of ticks and fly were highest during summer and spring seasons, respectively. Among various managemental and husbandry practices, quantitative burden of ectoparasites varied with the type of floors (P<0.05) being highest in animals kept on un-cemented floors followed in order by partially-cemented and cemented floor. Feeding, housing and animal keeping systems were not found associated with the prevalence of ectoparasites (P>0.05).

Discussion

The species of ectoparasites identified during present survey have also been reported earlier in various regions of the world (Azam *et al.,* 2002; Van den Broek *et al.,* 2003; Islam *et al.,* 2006; Petney *et al.,* 2007; Kakar and Kakarsulemankhel, 2008; Kabir *et al.,* 2011; Kebede and Teshome, 2012; Iqbal *et al.,* 2012; 2013). The prevalence has been documented 10.14-84.30% for ticks (Petney *et al.,* 2007; Kabir *et al.,* 2011; Iqbal *et al.,* 2013), 1.9-94% for lice (Colwell *et al.,* 2001; Kakar and Kakarsulemankhel, 2008; Tasawar *et al.,* 2008; Mahrukh and Juma, 2009; Kebede and Teshome, 2012), 5.19%-68.3% for mites (Kakar and Kakarsulemankhel, 2008; Fentahun *et al.,* 2012), 11.2% - 34.9% for fleas (Otake *et al.,* 1997; Araujo *et al.,* 1998) and 14.9%- 42.1% for flies (Khan *et al.,* 2006; Hasan *et al.,* 2008; Taylor *et al.,* 2012). As far as could be ascertained, flea infestation has been documented for the first time in Pakistan in cattle population. Fluctuations in rates of infestation could be due to varied geographical and climatic conditions of that area (Petney *et al.,* 2007). Seasonal dynamics of the ectoparasites observed during this survey is not different from those reported by Webb and David (2002), Wesonga *et al.* (2006), Muchenje *et al.* (2008), Rony *et al.* (2010) and Kebede and Teshome (2012). The hot-wet season provides optimum conditions (14^0C to 43^0C temperature; 41% to 65% humidity) for proliferation and survival of ticks and flies (Gray *et al.,* 2009). On the other hand, lice, mites and fleas were counted higher in cool-dry season (1ºC to 20ºC temperature; 51% to 75% humidity) as compared with hot-wet season in the study area (Chilton *et al.,* 2000; Zeleke and Bekele, 2004). Apart from climatic variations, other factors may also contribute in varied distribution of ectoparasites in an area like herd size, husbandry and managemental practices (Rony *et al.,* 2010). Lowest susceptibility of indigenous cattle (Sahiwal) can be attributable to the higher acquired resistance as a result of continuous exposure of ectoparasites (Whiteman and Parker, 2004; Muchenje *et al.,* 2008; Sajid *et al.,* 2009; Burger *et al.,* 2012). Resistance of indigenous breed to ectoparasites could be related to a pre-immunity against prevailing ectoparasites, skin hypersensitivity and increased grooming (Mattioli *et al.,* 2000; Burger *et al.,* 2012). The probable reasons for the higher prevalence in young age and female sex could be: (a) lower immune status in young stock, (b) poor nutritional status, (c) imbalance hormonal profile and (d) post calving stress (Marufu, 2008). Hibernating places in non-cemented floor pattern may play pivotal role for ovipositioning and developmental stages of ectoparasites, which leads to the higher infestation rate of ectoparasites in cattle (Sajid, 2009). Ectoparasites infested cattle become immunocompromised, hence susceptible to various viral and bacterial diseases, which may further deteriorate the physiological profile leading to huge productive failure. In this connection, it is advisable for the farming community with special reference to district T.T. Singh that: (a) a preventive therapy may be ensured to minimize attack rate of ectoparasites especially before the onset of their breeding season and (b) husbandry practices may be rationalized *viz.,* non-cemented floors should be discouraged.

Table 1: Prevalence and Associated Determinants of Ectoparasites Infesting Domestic Cattle in District T.T. Singh

Prevalence			(822×100/3864) = 21.27%				
Associated determinants	Variables	Levels	Prevalence (%)	Odds Ratio	P-value	95% C.I.	
						Lower limit	Upper limit
Agent species	Tick	*Hyalomma anatolicum*	20.16% (779/3864)	1.60	0.000	18.92	21.45
		Rhipicephalus microplus	12.63% (488/3864)	-	-	11.16	13.70
	Flea	*Ctenocepahlides (Ct). felis*	1.84% (71/3864)	1.94	0.002	1.45	2.30
		Ct. canis	0.96% (37/3864)	-	-	0.69	1.30
	Lice	*Haematopinus eurysternus.*	13.56% (524/3864)	3.97	0.001	12.51	14.67
		Damalinia bovis	9.08% (351/3864)	2.53	0.005	8.21	10.02
		Linognathus vituli	3.80% (147/3864)	-	0.004	3.23	4.44
	Flies	*Stomoxys calcitrans*	3.42% (132/3864)	-	-	2.88	4.02
	Mites	*Psoroptes bovis*	4.74% (183/3864)	1.97	0.010	4.10	5.44
		Sarcoptes scabei	2.46% (95/3864)	-	-	2.00	2.98
Host	Age	Adult	48.05% (395/822)	1.08	0.362	44.65	51.47
		Young	51.95% (427/822)	-	-	48.53	55.35
	Sex	Male	46.35% (381/822)	1.16	0.087	42.96	49.77
		Female	53.65% (441/822)	-	-	50.23	57.04
	Breed	Cross-bred	23.57% (330/1400)	5.03	0.0017	21.40	25.85
		Friesian	48.0% (168/350)	9.79	0.001	42.79	53.24
		Jersey	36.40% (273/750)	7.26	0.003	33.01	39.89
		Sahiwal	3.73% (51/1364)	-	0.004	2.83	4.85
Husbandry Practices	Feeding system	Stall feeding	53.52% (440/822)	1.00	0.058	50.11	56.92
		Grazing	46.47% (382/822)	1.01	0.053	43.08	49.89
	Housing system	Open	31.26% (257/822)	1.01	0.061	28.16	34.50
		Close	36.49% (300/822)	1.02	0.059	33.26	39.83
		Semi close	32.23% (265/822)	-	0.073	29.11	35.49
	Floor pattern	Non-cemented	43.91% (361/822)	2.17	0.001	40.55	47.33
		Partially cemented	31.63% (260/822)	1.29	0.004	28.52	34.87
		Cemented	24.45% (201/822)	-	0.005	21.61	27.48
	Animal keeping	Free	47.08% (387/822)	1.02	0.057	43.68	50.50
		Tethered	52.91% (435/822)	-	0.059	49.50	56.32

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References

Alim, M.A., S. Das, K. Roy, M. Masuduzzaman, S. Sikder, M.M. Hassan, A.Z. Siddiki and M.A. Hossain, 2012. Prevalence of hemoprotozoan diseases in cattle population of Chittagong division, Bangladesh. *Pak. Vet. J.,* 32: 221–224

Araujo, F.R., M.P. Silver, A.A. Lopes, O.C. Riberio, P.P. Pires, C.M.E. Carvalho, C.B. Baluena, A.A. Villas and J.K.M. Ramos, 1998. Severe flea infestation of dairy calves in Brazil. *J. Vet. Parasitol.,* 80: 83–86

Azam, M., M.M. Siddiqui and G. Habib, 2002. Prevalence of parasitic infection in buffalo calves in Khadagzai, district Dir. *Pak. Vet. J.,* 22: 87–90

Burger, J.R., S. Adrian, P.M. Chesh, F. Fernando, A.E. Luis and D.H. Loren, 2012. Sociality, exotic ectoparasites, and fitness in the plural breeding rodent octodon degus. *Behav. Ecol. Sociobiol.,* 66: 57–66

Chilton, N.B., R.H. Andrews and C.M. Bull, 2000. Influence of temperature and relative humidity on the moulting success of *Amblyomma limbatum* and *Aponomma hydrosauri* (Acari: Ixodidae) larvae and nymphs. *Int. J. Parasitol.,* 30: 973–979

Colebrook, E. and R. Wall, 2004. Ectoparasites of livestock in Europe and the Mediterranean region. *Vet. Parasiotol.,* 120: 251–274

Colwell, D.D., B. Clymer, C.W. Booker, P.T. Guichon, G.K. Jim, O.C. Schunicht and B.K. Wildman, 2001. Prevalence of sucking and chewing lice on cattle entering feedlots in southern Alberta. *Can. Vet. J.,* 42: 281–285

Fentahun, T., A. Mekash and C. Mersha, 2012. Demodex and Sarcoptes Mites of Cattle: An extravagance for leather industry. *American-Eurasian J. Sci. Res.,* 7: 13–135

Gray, J.S., H. Dautel, A. Estrada-Peña, O. Kahl and E. Lindgren, 2009. Effects of climate change on ticks and tick-borne diseases in Europe. *Interdis. Pers. Infec. Dis.,* doi:10.1155/2009/593232

Hasan, M., M.N. Khan, Z. Iqbal, I.A. Khan, S.A. Chaudhry and M.S. Sajid, 2008. Surveillance of cattle hypodermosis in district Chakwal. *Int. J. Agric. Biol.,* 10: 337–339

Iqbal, A., M.S. Sajid, M.K. Khan and Z. Furhaad, 2012. Concurrent infestation of buffalo calves with *Ctenocephalides felis strongylus* and piroplasms. *Pak. Vet. J.,* 32: 144–146

Iqbal, A., M.S. Sajid, M.N. Khan and M.K. Khan, 2013. Frequency distribution of hard ticks (Acari: Ixodidae) infesting bubaline population of district Toba Tek Singh, Punjab, Pakistan. *Parasitol. Res.,* 112: 535–541

Islam, M.K., M.A. Alim, N. Tsuji and M.M. Mondal, 2006. An investigation into the distribution, host-preference and population density of ixodid ticks affecting domestic animals in Bangladesh. *Trop. Anim. Hlth. Prod.,* 38: 485–490

Kabir, M.H.B., M.M.H. Mondal, M. Eliyas, M.A. Mannan, M.A. Hashem, N.C. Debnath, O.F. Miazi, C. Mohiuddin, Kashem, M.R. Islam and M.F. Elahi, 2011. An epidemiological survey on investigation of tick infestation in cattle at Chittagong district, Bangladesh. *Afr. J. Micro. Res.,* 5: 346–352

Kakar, M.N. and J.K. Kakarsulemankhel, 2008. Prevalence of endo (trematodes) and ecto-parasites in cows and buffaloes of Quetta, Pakistan. *Pak. Vet. J.,* 28: 34–36

Kebede, N. and F. Teshome, 2012. Population dynamics of cattle ectoparasites in Western Amhara National Regional State, Ethiopia. *J. Vet. Med. Anim. Hlth.,* 4: 22–26

Khan, M.N., Z. Iqbal, M.S. Sajid, M. Anwar, G.R. Needham and M. Hassan, 2006. Bovine hypodermosis: Prevalence and economic significance in southern Punjab, Pakistan. *Vet. Parasitol.,* 141: 386–390

Mahrukh, N.K. and K.K. Juma, 2009. Prevalence of lice species on cows and buffalos of Quetta, Pakistan. *Pak. Vet. J.,* 29: 49–50

Marufu, M.C., 2008. Prevalence of ticks and tick-borne diseases in cattle on communal rangelands in the highland areas of the Eastern Cape Province, South Africa. (*Unpublished M.Sc. Thesis,* University of Forte Hare, South Africa)

Mattioli R.C., V.S. Pandey, M. Murray and J.L. Fitzpatrick, 2000. Review: Immunogenetic influences on tick resistance in African cattle with particular reference to trypanotolerant N'Dama (*Bos taurus*) and trypanosusceptible Gobra zebu (*Bos indicus*) cattle. *Act. Tropic.,* 75: 263–277

Muchenje, V., K. Dzama, M. Chimonyo, J.G. Raats and P.E., Strydom, 2008. Tick susceptibility and its effects on growth performance and carcass characteristics of Nguni, Bonsmara and Angus steers raised on natural pasture. *J. Anim. Sci.,* 2: 298–304

Niyonzema, A. and H.H., Kiltz, 1986. Control of ticks and tick-borne diseases in Burundi. *ACIAR Proceed.,* 17: 16–17

Oruc, H.H., S. Senturk, M. Kahraman, V.Y. Cirak and E. Akdesir, 2012. Suspected hairy vetch (*Vicia villosa*) poisoning with a concomitant babesiosis in dairy cows in Turkey. *Pak. Vet. J.,* 32: 471–473

Otake, O., K. Maehara and K.S. Imi, 1997. Massive infestation of fleas in dairy rearing calves. *Jpn. Vet. Med. Assoc.,* 50: 92–94

Petney, T.N., G.V. Kolonin and R.G. Robbins, 2007. Southeast Asian ticks (Acari: Ixodida): A historical perspective. *Parasitol. Res.,* 101: 201–205

Raut, P.A., V.G. Sonkhusale, L.A. Khan, M.K. Nakade, N.S. Pagrut and A.M. Bodkhe, 2008. Haematological changes in cattle associated with arthropods infestation. *Vet. Wld.,* 11: 338–339

Rony, S.A., M.M.H. Mondal, N. Begum, M.A. Islam and S. Affroze, 2010. Epidemiology of ectoparasitic infestations in cattle at bhawal forest area, gazipur. *Bangl. J. Vet. Med.,* 8: 27–33

Sajid, M.S., M.N. Khan, Z. Iqbal and G. Muhammad, 2008a. Comparative efficacy of ivermectin and cypermethrin against *Hyalomma anatolicum* (Acari: Ixodidae). *Proc. XXIII International Congress of Entomology International Convention Centre, Durban, South Africa*

Sajid, M.S., Z. Iqbal, M.N. Khan and G. Muhammad, 2008b. Point prevalence of hard tick infesting domestic ruminants of lower Punjab, Pakistan. *Int. J. Agric. Biol*., 10: 349–351

Sajid, M.S., Z. Iqbal, M.N. Khan and G. Muhammad, 2009. In vitro and in vivo efficacies of ivermectin and cypermethrin against the cattle tick *Hyalomma anatolicum anatolicum* (Acari: Ixodidae). *Parasitol. Res.,* 105: 1133–1138

SAS, 2010. *SAS/STAT Users Guides Version 6.12*. SAS Inst. Inc, Cary, NC

Shemshad, M., S. Khadijeh M.S. Mohammad, S. Majid, B. Alireza, B. Mojgan and R. Javad, 2012. First survey of hard ticks (Acari: Ixodidae) on cattle, sheep and goats in Boeen Zahra and Takistan counties, Iran. *Asian Pacific J. Trop. Biomed.,* 2: 489–492

Soulsby, E.J.L., 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*, 2nd edition. (Bailliere Tindall, London, UK)

Tasawar, Z., I. Bano, C.S. Hayat and M.H. Lashari, 2008. Prevalence of lice on buffalos at private cattle farm. *Pak. Vet. J.,* 28: 147–149

Taylor, D.B., R.D. Moon and D.R. Mark, 2012. Economic impact of stable flies (Diptera: Muscidae) on dairy and beef cattle production. *J. Med. Entomol*., 49: 198–209

Thrusfield, M., 2007. *Veterinary Epidemiology*, p: 178. (Blackwell publishing, London, England)

Van den Broek, A.H.M., J.F. Huntley, R.E.W. Halliwell, J. Machell, M. Taylor and H.R.P. Miller, 2003. Cutaneous hypersensitivity reactions to *Psoroptes ovis* and Der in sheep previously infested with *P. ovis* the sheep scab mite. *Vet. Immunol. Immunopathol.,* 91: 105–117

Walker, A.R., R.D. Moon and E.B.M. Koney, 2003. Distribution of ticks infesting domestic ruminants in Ghana. Bull. *Entomol. Res.,* 89: 473–479

Webb, E.C. and M. David, 2002. The efficacy of neem seed extract (*Azadirachta indica*) to control tick infestation in Tswana, Simmentaler and Brahman cattle. *S. Afr. J. Anim. Sci.,* 32: 1–6

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

Whiteman, N.K. and P.G. Parker, 2004. Effects of host sociality on ectoparasite population biology. *J. Parasitol.,* 90: 939–947

Zeleke, M. and T. Bekele, 2004. Species of ticks on camels and their seasonal population dynamics in Ethiopia. *Trop. Anim. Hlth. Prod.,* 36: 225–231

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