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Review Article

Remedial Strategies Against an Emerging Threat of Ticks in Goats: A Review

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Abstract

Current study was conducted in order to explore the prevalence of ticks infestation as well as different curative strategies against tick infestation in goats. In this regards a detailed review was carried and the obtained results were found much interesting and useful. It was noticed that the prevalence of tick infestation in goats is 70% compared other diseases. Female goats suffers more (82.84%) compared to males (56.25%). All the tick-infested goats show the clinical signs of weakness, anaemia, and anorexia, hair loss and skin damage. It was further reported various application are used for controlling this emerging threat in goat, however, the efficacy rate of Trichlorfon remains significantly higher (78.4 to 85.6%) compared to other applications. Further, the Cypermethrin was reported as second most effective (68 to 81.6%) effective application after Trichlorfon. In conclusion, Trichlorfon has been proved most effective drug against the tick infestation in goats compared to all other application. It may safely be used against emerging threat of ticks.

Keywords: Drug resistance; Efficacy; Goat; Ticks infestation

Introduction

Infestation of ticks is a dangerous threat to the farmers of goat raising areas of the developing countries where people are dependent on goats for their lively hood, economically, ticks reduce the good quality of hides and skins, tick injuries produce secondary infection on the skin, irritation and allergic skin also has no economic value, while excessive chemical use toxicosis cause the decrease in production [1]. The tick prevalence has been observed in goats worldwide. Tick prevalence and factors related to ectoparasitism problem were studied in goats of two separate agro-climatic regions in India [2]. Tick infestations in livestock causes huge economic losses worldwide, as the United Nations Food and Agricultural Organization (FAO) reported that in 1984, Ixodidae tick infestations cause severe losses of $US 7.0 billion, and ticks transmit several types of pathogens like virus, bacteria, and haematoprotozoan between animals to animals and human during blood-sucking [3].

Goat plays a significant role in the livestock sector. The goat populations around 90% found in world's developing or under developing countries such as Pakistan, South Africa, Nigeria, India, Bangladesh and Sudan [4]. Goats fulfill the demand of meat, milk, skin and by products for national and international export. Goats are well known for their good adaptation and are resistant to endemic diseases. There are many diseases of the goat including bacterial, viral, protozoal and metabolic disorders that causes economic losses [5]. Amongst all ticks infestation is very common in goats that cause major constraint in production, morbidity and mortality with clinical signs of anemia, weight loss, retarded growth, paralysis, reduce their production and intense irritation leading to skin damage that causes huge economic losses by reducing the quality and market value of skin [6]. It also causes weakness and decreases production that has a serious economic impact on goat farming and individual and national goat production in underdeveloped countries. Although treatment of infection is attempted by using difference drugs, but in most of cases therapy fails to cure the cure animals. Major causal factors in the development could be drug resistance or the misuse of acaricides formulation with improper concentration [7]. Keeping in view these all facts current study was

planned, whereby the main motive was to investigate the curative strategies against the emerging threat of tick in goats worldwide.

Threat of ticks infestation in goats

Ticks cause the loss in productivity through blood loss, hide damage and transmitting of different bacterial, viral and protozoal diseases [8]. Ectoparasites infestation reduce economic gains and affects the welfare of farm animals [9]. Increased incidence of blood protozoan diseases is present where ticks act as intermediate hosts [10]. Ticks have a few natural predators and quickly develop resistance to drugs so controlling of tick infestation is very difficult [11,12]. Disease surveillance and diagnosis is very low, and it causes obstruction to livestock health [13]. The highest incidence of tick infestation is recorded among cattle (60.50%) followed by (25.90%) in goats [14]. There are many reports from worldwide about the tick infestation, such as [9] reported as high as 81.25 percent incidence of tick infestation in cattle, The study by Prakasan & Ramani [10] reflected about 58.60 percent tick infestation from South India.

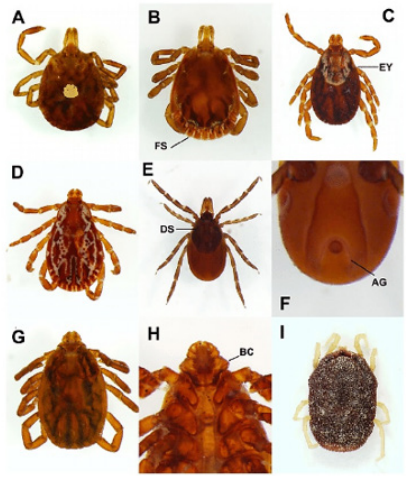
It has been further stated that the ticks cause different clinical signs and lesions in goats which include anemia, weight loss and decrease blood protein levels, reduced fertility, abortion, and unthriftiness condition and increased in susceptibility to bacterial and viral disease and death. Figure 1 is showing tick infestation reports in goat. The result of interactions among different types of external was found different in different geographical regions; the life cycle of external parasites was also dependent on different environmental condition and kinds of farm management, and the host factors reported [15]. Tick infestation in goats at district Uttarakhand from March to June (2016). Total present percentage of tick infestation was noted 72.11% and three species of ticks were identified i.e. *Rhipicephalus Boophilus microplus, Haemaphysalis species, Hyalomma species* (47.11, 16.34 and 8.65%) respectively. The most common tick infestation sites on body surfaces of the goats were recorded on the ears (53.57%) followed by anus and external genitalia (14.58%) and around eyes (6.25%). The higher tick infestation (54.16%) was observed during the summer season observed [16].

Figure 1: Different tick infested areas in goats.

Another study was carried out on infestation of hard ticks (Ixodid) and management system i.e. age, housing, grazing and different body condition of the animals in Pakistan during the summer months of 2011 in Pakistan. They observed that from a total of 170 goats only 95 goats had tick infestation of 5 species of ticks which were *Haemaphysalis, Rhipicephalus, Boophilus, Amblyomma*, and *Ixodes* with infestation rate 27.40, 21.92, 11.89, 10.02 and 7.35% respectively.

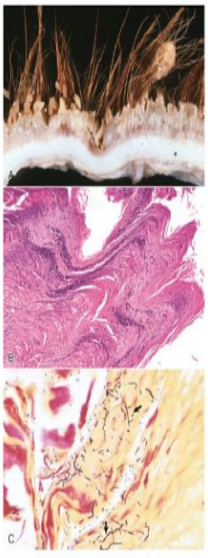
The rate of tick infestation was higher of *Haemaphysalis* and lower of Ixodes ticks performed [17]. The prevalence of Ixodid ticks from July 1991 to June 1992 in the Chittagong hilly area of Bangladesh was reported. Figure 2 is showing the histological versus macroscopic lesion caused by ticks. It was indicated that 65.45% of cattle and 44.4% of goats were infested with different ectoparasitic species of tick such as *Boophilus microplus, microplus, rhipicephalus, appendiculatus* and *haemaphysalis*, and they also reported that the rate of tick infestation was higher in the summer season and reduced or lower in the winter season [18]. The prevalence percentage on tick infestation, in addition, identifying different species of ticks in small ruminants at Eastern Ethiopia was carried out. The highest rate of tick prevalence was observed 72.39% in sheep and goat and individual prevalence percentage was observed in goats 73.9% and in sheep 70.7%. During this studied only 8 species of ticks were identified. The most common species found which were *Rhipicephalus pulchellus, Amblyomma variegatum, Rhipicephalus evertsievertsi, Hyalomma truncatum, Hyalomma marginatum rufipes* and *Amblyomma gemma* (34.1, 24.5, 22.1, 15.6, 12.2 and 10.9%). However, the difference in the rate of tick prevalence was found statistically significant ($P<0.05$) between the sex, age exception of *Boophilus decoloratus* and *Hyalomma dromedari* in all cases male ticks dominated females were observed [19].

The prevalence of tick infestation and correlation of Theileriosis infection in small goats at the National Agricultural Research Centre (NARC) Islamabad and Barani Livestock Production Research Institute (BLPRI) Kherimurat district Attock, Pakistan was carried out. A total of 662 small ruminants (219 sheep and 443 goats) examined clinically and by laboratory screening for the presence of ticks and Theileriosis infection. The 95 sheep and 184 goats were infested with the different species of ticks; the prevalence rate was observed 43.37% and 41.53% in sheep and goats respectively. The difference in the prevalence of tick infestation between sheep and goats was statistically significant (P≤0.01). The most prevalent ticks were identified as *Rhipicephalus spp.* infesting the sheep and goats. Figure 3 is showing some ticks species of goat concern.



(A) Amblyomma americanum (female). (B) A. americanum (male).
(C) Dermacentor variabilis (female). (D) D. variabilis (male).
(E) Ixodes scapularis (female, dorsal). (F) I. scapularis (ventral).
(G) Rhipicephalus sanguineus (female, dorsal). (H) R. sanguineus (ventral).
(I) Ornithodoros turicata.
AG, anal groove; BC, basis capituli; DS, dorsal shield; EY, eye; FS, festoons.

Figure 2: Some ticks species of goat importance.



(A) The hair is matted by a thick crust composed of dried exudate, stratum corneum, and bacteria.

(B) The crust is stratified and formed of alternating layers of hyperkeratotic stratum corneum, proteinaceous fluid, and degenerate neutrophils.

(C) The stratum corneum contains Gram-positive bacteria (arrows) that subdivide longitudinally and transversely and can result in filaments that have a "railroad track" (not evident here) or "branched" appearance.

Figure 3: Some histological changes in the skin caused by ticks.

Theileriosis was observed in sheep 7.36% (7/95) and in goats 3.8% (7/184) respectively and there was no significant difference between the sheep and goats were observed [20]. Tick infestation rate in domestic ruminants during 2009 in county Ilam was studied. Samples were collected from 25 villages (15 animal farms). The tick samples were collected from the 416 cattle, 147 goats, and 208 sheep. The tick prevalence rate was observed 43, 49/6 and 23.5 % from cattle, goats, and sheep respectively. The total ticks 328, 415 and 573 were collected from cattle, goat, and sheep respectively. The highest tick infestation was recorded *Hyalomma anatolicum anatolicum spp.* (71.4%), *Hyalomma asiaticum asiaticum spp.* (17.6%) and *Rhipicephalus bursa spp.* (11%) frown cattle. While goats had *Rh. bursa spp.* (41.5%), *Rh. sanguineus spp.* (43.2%) and *Ha. inermis spp.* (15.3%) tick infestation rate. However, sheep had *Hy. anatolicum spp.* (32.1%), *Rh. bursa spp.* (42.2%), *Rhipicephalus sanguineus spp.* (17.3%) and *Haemaphysalis inermis spp.* (8.4%). The total ticks infestation rate was observed (43%), (49.6%) and (23.5%) in cattle, goats, and sheep respectively. The ticks on the body surface of infested animals have the highest infestation rate at udder and tail (21%) in cattle, ear (63%) and tail (17%) in goats and ear (42.5%) and tail (30%) in sheep. The lowest rate of tick infestation was observed in the ear and shoulder (2%) in cattle, udder (7%) in goats and head and neck (2%) in sheep was observed [21].

The tick infestation in different species of livestock was studied, whereby the total, 3,807 ticks were collected representing the four species *Hyalomma anatolicum spp*, *Rhipicephalus microplus spp, Hyalomma dromedarii spp, Rhipicephalus turanicus spp* with the number of 3,021, 715, 41 and 30 respectively. The most prevalent species were *Rhipicephalus microplus spp and H. anatolicum spp.* It was the highest in cattle (89.9%), followed by buffaloes (81.4%), goats (60.0%) and sheep (11.1%). The female animals had significantly higher tick infestation rate as compare to male males, in large ruminants; older animals were higher tick infestation than younger animals were observed [22]. The infestation of ectoparasites of goats from the North West region of Iraq, during 2010 was focused. Twelve hundred and forty-eight (1248) sheep and 954 goats from 110 flocks of different villages were examined. The tick infestation rate was found (66.89%). The total 720 (57.7%) sheep and 753 (78.9%) goats were infested with the five different species of ectoparasites, ticks (46.7%,34.9%), lice (3.8%,33.8%), mites (7.1%,0.1%), fleas (2.8%,7.75%) and ked (1.2%,4.5%) respectively. Only five species of hard ticks (Ixodidae) were identified from sheep and goats namely *H. marginatum, Hyalomma anatolicum anatolicun, R. turanicus, Rhipicephalus sanguineous,* and *Haemaphysalis*. Two species of lice were found *Damalinia Ovis* and *Linognathus stenopsis* on sheep, and *D. caprae* and *L.stenopsis* on goats. Three species of fleas were found infested *Xenopsylla cheopis, Ctenocephalides felis felis* and *Pulex irritans* in sheep and goats respectively [23].

Curative strategies against ticks infestation

The cypermethrin has been reported as an external parasite killer compound. It has been used to control the ticks, lice, and flies of the livestock, there are many reports as the efficacy of cypermethrin and drug-resistant adopted by ticks such as *Rhipicephalus microplus* ticks, as reported [24], where systemic and topical drugs like acaricides were previously failed to control *Rhipicephalus (Boophilus) microplus* infestations, an initially a single dose of injections Ivermectin 630 µg/kg subcutaneous was used, although there was reduction of 50%-75% in ticks that persisted for 30-40 days, however, Cypermethrin (150ppm) was found completely ineffective. The organophosphate Trichlorfon exhibited intermediate efficacies of approximately 60%. Therefore, it was concluded that there was a high degree of resistance to Ivermectin, and it was unable to eliminate tick infestations from cattle. Comparative efficacy of Ivermectin and Cypermethrin was observed against the tick infestation in bovines as reported [25]. A total of 480 ticks were exposed to Ivermectin (IVM) and Cypermethrin (CYM) pour-on efficacy at recommended doses of the manufacturer. The results of the comparative efficacy against tick burden were observed on days 0,5,10,15 and 20 after treatment using. The higher efficacy of Cypermethrin in vivo was observed as compared to Ivermectin with a single dose. The *Cypermtherin* was not effective against tick infestation of *Rhipicephalus (Boophilus) microplus* in India. While Deltamethrin and Cypermethrin had shown the resistance in the field isolates of *Rhipicephalus (Boophilus) microplus*. The overall synthetic pyrethroid resistant was observed at 66.6% (18/27) among the *Rhipicephalus (Boophilus) microplus* [26]. The efficacy of an Amitraz/Cypermethrin pour-on preparation against natural tick infestations of goat and sheep also were reported [27], who reported that Amitraz/Cypermethrin was effective against different species of ticks such as *Amblyomma*, *Rhipicephalus*, and *Hyalomma* in goats.

In another study, the tick infestation in different goat breeds was observed [28] from Muzaffargarh and Layyah Punjab, Pakistan. They observed the prevalence of tick infestation from 800 goats, the result of the overall prevalence was observed at 60.1% (481/800) in both districts of Punjab. The highest prevalence of *Hyalomma* tick was observed in Layyah, district Muzfar Garh. The most predominant species was recorded (*Rhipicephalus sanguineus*) in both districts. The female goats were highly infested (72.8%) as compared to males (47.5%), while in contrast; younger animals had more tick infestation (63.5%) as compared to older (56.7%). Further, the efficacy of four acaricides drugs Deltamethrin, Amitraz, Diazinon, and Ivermectin was compared against tick infestation in sheep and goats [29]. The first three products Cypermethrin, Amitraz, and Diazinon were used for dipping at a concentration of 0.05%, 0.05%, and 0.04% respectively. Ivermectin (1%) was injected at the dose rate of 0.2 mg/kg subcutaneously. A total number of 1054 of ticks

(938 females, 116 males) were collected from infested sheep and goats. The best acaricidal efficacy was observed for Cypermethrin 79.5%, 100% at 3 and 5 days respectively. Amitraz had 90.4% and 100% efficacy at 3 and 5 days respectively. The tick infestation was observed at the different body parts, the preferred sites of tick attachment were observed at perineal region and ears. The Cypermethrin dipping treatment was effective 100% after one day and after the next 4 weeks, the rate tick infestation was reached again 50%.

The efficacy of an Amitraz with Cypermethrin against tick infestations in buffaloes was studied. It was found that the Amitraz/Cypermethrin was very effective against *Rhipicephalus appendiculatus, Rhipicephalus evertsi evertsi, Amblyomma hebraeum*, and *Hyalomma marginatum rufipes*. Both drugs were effective against *R. appendiculatus* and *Rhipicephalus (Boophilus) decoloratus* and *R. (Boophilus) decoloratus* reported [30]. In another study, Trichlorfon efficacy trial has proved that this drug is very effective against the tick and other skin parasites [31]. Trichlorfon is an organophosphate insecticide used to control bedbugs, fleas, cattle grubs, flies, ticks, leaf miners, and leaf hoppers as well as, for treating domestic animals for the control of internal parasites [12]. Haque et al. [32] conducted a field survey in goats to observe the tick resistant to *acricides*. The larvae obtained of engorged female *A.hebraeum, Hyalloma, Boophilus, Dermacentor, Ixodes, R. appediculatus* and *R. evertievertsi* with different concentration of Trichlorfon, Ivermectin and Cypermethrin. Ticks were equally resistant to Ivermectin, Trichlorfon and Cypermethrin and in general Trichlorfon and Cypermethrin mixture was effective against resistant ticks. The efficacy of Trichlorfon against ticks in sheep in Argentina. Trichlorfon efficacy was very effective to control the ticks and external parasites as 83.45% against the control of cattle ticks as reported [33]. It has further been studied that the compound Trichlorfon has been proved much successful for treating the resistant ticks. Dong et al. [34] investigated 17 cattle farms in Inner Mongolia for the tick's infections of *Boophilus micro plus*. The adult ticks were controlled by using 1% trichlorfon solution applied on body surface or by spraying. These both methods were found effective in killing *Boophilus micro plus* at herd level. Neguvon R trichlorfon 98% (Bayer, Germany) was also effective to control all external parasites strategy, including ticks when it was applied as 0.15% solution on the external body surface by means of dipping or spray [35].

Conclusion and Recommendations

The study concludes that ticks infestation is a common threat to the goats throughout the world. This threat may by efficiently be controlled by using Trichlorfon. Further, Trichlorfon has been proved most effective drug against tick infestation in goats compared to all other application. It may safely be used against emerging threat of ticks.

Tick control program should be implement worldwide using drug namely Trichlorfon in form of dipping or spray. Further studies should be carried out with different formulation in combine state to determine the synergetic effect of different drugs combination activity to decrease drug resistant adaptation by the ticks.

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Conflict of Interest

No Conflict of interest.

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