Studies on prevalence, risk indicators and control options for tick infestation in ruminants

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ABSTRACT

An epidemiological study was conducted at Benisuef district to determine the current situation and associated determinants of tick infestations in ruminants and to assess the efficacy of three different types of insecticides against tick infestation under field conditions. Total of (1082) animals of different species (540 cattle, 230 buffaloes, 108 of each sheep & goats and 96 camels) were selected randomly and examined carefully for tick infestation. About (30.1%) of total observed animals were found tick infested with highest rate in cattle (60.5%) followed by goats (25.9%), buffaloes (17.8%), sheep (14.8%) while no tick infestation recorded in camels. The most prevalent tick’s species affecting ruminants was Boophilus annulatus (26.5%) followed by Hyalomma anatolicum (6.1%) then Rhipicephalus turanicus (3.4%). Regarding the associated risk factors, tick infestation was found statistically significant ($P < 0.05$), as the highest infestation rates were recorded in Friesian cow’s breed (77.5%), older ages, > 3 years (78.8%) followed by at age, ≤ 2 months (57.8%) and during summer months were found highly significant ($P < 0.01$) in cattle (76.5%) followed by goats and sheep (33.3% & 22.9% resp.) comparing with results in winter. The preferred sites of ticks’ attachment to infested animals were udders and external genitalia (70.7% of each) then Neck & chest (63.0% of each), inner thighs (61.1%), perineum (41.7%), ears (14.6%), around eyes (11.7%). The obtained results revealed that poor husbandry practices of small holder farmers be a determinant making the animals more prone to tick infestation in this district. Improving the hygienic conditions associated with treatment of infested cattle with Ivermectin (0.2 mg/kg b.wt, S/C) and spraying of Deltamethrin (1%) for surrounding environment twice every 14 days are recommended for control of tick infestation under field condition.

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1. Introduction

Ticks are economically the most important pests of cattle and other domestic species in tropical and subtropical countries (Jongejan and Uilenberg, 1994). More than 80% of the world cattle population is infested with ticks (FAO, 1984), which cause harm to animals through blood loss, general stress and irritation, depression of immune function, damages to hides and skins (Ghosh et al., 2007). Although, economic losses due to ticks are mainly due to the diseases which they transmit (Garcia, 2003), financial losses associated with nagging irritation and depreciation of the value of skins and hides (up to 20–30%) are also significant (Biswas, 2003). Further, with the changing environmental conditions due to global warming, the epidemiology of the tick infestations and vectorial potential of the ticks are likely to change and failure to control tick infestations is considered as a major factor limiting the sustainable livestock production world-wide and especially in tropical country like Egypt (Kabir et al., 2011).

Susceptibility and Resistance of animals to tick infestation have been influenced by several factors including: species, age, sex, season, breed, photoperiod and management. Chemical application of acaricide is still the most widely used way of control, although there are reports of tick resisting to many active principles in different countries (Martins et al., 1995) that are applied by dipping, spraying or pour-on which is considered as one of the best methods.

The current tick control strategies aim to reduce ticks numbers to acceptable levels, to prevent production loss, minimize chemical residue risks, and reduce the reliance on chemicals by utilizing control with alternative treatments for different herd group’s (Ghosh et al., 2007).

In Egypt, ticks are the most important of all ectoparasites. The economic loss incurred when they infest livestock particularly, cattle are enormous. In spite of the aforementioned prevailing situation and the presence of a number of problems due to ticks in Egypt, there is paucity of well-documented information on the occurrence of ticks in the study area and insufficient to develop a proactive program for ticks’ control at both smallholder and cattle farm levels (Asmáa, 2012). Therefore, this study was designed with the objectives of determining the prevalence of ticks, assessing the risk factors of tick infestation in the study animals and recommending best tick control options in the area.

2. Materials and methods

2.1. Study area and period

A cross sectional study was carried out during the period from the beginning of November (2012) to September (2013) in Beni-Suef district. Study area is located at Latitude (30.13) degrees north, Longitude (31.40) degrees east, and rises above the sea level by (46) meters. Generally, it characterized by two distinctive seasons; summer (May to October) and winter (November to February) Egyptian Metrological Authority (2012).

2.2. Sampling technique

A total of (1082) animals of different species (540 cattle, 230 buffaloes, 108 each of sheep & goats and 96 camels) were selected randomly from small holders of cattle irrespective of their age, sex, breed and examined for the presence of ticks infestation and most likely associated risk factors in animal population according to method adopted by (Thrusfield, 2005).

2.3. Collection and preservation of samples

The selected animals of different species were properly casted then clinically inspected for tick infestation, half body tick counts were made for each animals then adult ticks were collected from different body sites (ears, around eyes, etc.) and transferred separately in universal bottles containing (70%) ethyl alcohol then dispatched to parasitological lab of Animal Health Research Institute for further identification of tick specimens. Required information like date of collections, place of collection, body site of collection, species and breed of host were recorded.

2.4. Identification of tick species

The ticks genus and species were identified under stereo microscope in the laboratory and the half body tick counts were doubled to obtain whole body tick burden according to (Keiser, 1987; Walker et al., 2003).

Prevalence (P) was estimated according to (Thrusfield, 1995) using formula

\[
P = \frac{\text{No. of infested cases during specified period}}{\text{Population at risk during that specified time period}} \times 100
\]

3. Evaluation trial of the efficacy of three different types of acaricides on cow’s tick infestation

3.1. Study area and animals

A seventy days study was carried out on (1080) Friesian cattle in a private farm at Benisuef district. A farm selection criterion was based on a previous history of tick infestation, existing of potential risk indicators and insecticidal resistance. All cows in the herd were qualitatively examined for tick infestation then eighty animals from those found positive were selected and allocated randomly into four equal treatment groups (I, II, III and IV). All groups were isolated apart from each other while the remaining cows in the herd (n = 28) was kept as control group without any treatment during experimental period. The tick infestation & distribution were determined quantitatively in all examined groups before study as method described by (Sajid et al., 2009).

3.2. Insecticides used

Three commercial insecticides were tested against cow’s tick infestation as recommended by manufacturers

1. Diazinon (60 % EC), diluted with distilled water,
2. Deltamethrin (50%, Intervet Schering-Plough Animal Health), Butox, at (0.1%) for animal used and (1%) for surrounding environment.

3. Ivermectin (Ivomec): a product of Marial Private Limited has given subcutaneously at the rate of 0.2 mg/kg b.wt.

3.3. Study implementation

The trial was conducted as technique adopted by (Sajid et al., 2009) with some modifications as infested cows in the four examined groups were kept under good hygienic conditions besides application of insecticide corresponding to each group throughout study period. Whereas cows in treated group TG (I & II) and their surrounding environment (bedding material, wall, fomites, etc...) were sprayed twice, 14 days interval with insecticides (Diazinon and Deltamethrin (Butox-50, Intervet) resp.,) at concentration (0.1% & 1% resp.,) using a backpack-sprayer while animals in TG (III) received only Ivermectin (Ivomec, Merial) at rate of (200 μg/kg, S/C) once a time. On the other hand, cows in TG (IV) received the same treatment of cows in TG (III) besides spraying of cow’s surroundings with Deltamethrin (Butox-50, Intervet) at conc (1%) three times at 14 days intervals.

The efficacy of different treatments (%) was calculated at days (7, 21, 35, 50 & 65) by using the following formula.

\[
\text{Efficacy} \% = \frac{\text{No. of animals cured}}{\text{total no of animals treated}} \times 100
\]

**Statistical analysis** was carried out by using statistical package for social science (SPSS) using F test. Moreover, to compare the prevalence of ticks of cattle of both sexes, ages, breeds, rearing system, seasons and topography of the area, data were analyzed by using paired sample t test (Mostafa, 1989).

4. Results

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<tr>
<th>Table 1 – Prevalence and distribution of tick infestation in different animal species.</th>
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<td>Animals</td>
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<td>Cattle</td>
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<td>Total</td>
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<th>Table 2 – Prevalence and distribution of tick infestation in relation to breed, age and sex.</th>
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<td>Cattle</td>
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<td>Exam</td>
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<tr>
<td>Examined</td>
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<td>Infested (%)</td>
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<th>Table 3 – Prevalence and distribution of tick infestation in different cattle breeds.</th>
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<td>Breed</td>
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<td>Local</td>
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<td>Friesian</td>
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<td>Total</td>
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Nearly similar results were found by Atif et al. (2012) who revealed that the prevalence of tick species recorded from the study area was Hyalomma (Hy.) anatolicum (22.86%, 240/1050), Rhipicephalus (Boophilus) microplus (21.33%), Rhipicephalus sanguineus (7.52%) and Rhipicephalus (Boophilus) annulatus (1.43%, 15/1050) and Haemaphysalis spp. (1.62%). Tomassone et al. (2004) found that Boophilus sp. was the most numerous adult’s ticks (57.1%) while Rhipicephalus sp. were (12.4%). Bourne et al. (1988) reported that large difference in tick numbers could arise from differences in cattle breeds, due to their location and type of pasture. Cattle with lower resistance allow more ticks to survive.

Table 2 revealed that tick infestations were significantly differ \((p < 0.05)\) in relation to cattle breed, age and sex, as infestation rate was significantly higher in Friesian breed (77.5%) than balady (50.4%) and cross (Friesian x balady, 41.8%), moreover, infestation rate was higher in older animals aged >3years (78.8%) followed in order by young calves \(\leq 2\) month (57.8%) and lowest in age 1–3 year (44.4%). The sex had also an influence on the tick prevalence, where the prevalence was higher in female followed by male cattle (58.7 & 41.5% resp.). The results of present study agree with Manan et al. (2007) who found that resistance in the animals was building up as the age advances and the animals became more adoptable than in younger state irrespective of the farm species. On the other hand, Islam et al. (2009) found that calves more susceptible to tick infestation 2.0 times more than the adults and older animals. Stuti et al. (2007) reported that, calves (below one year) were the most susceptible (65.38%) followed by grownups (34.60%) and adults (14.91%) cattle.

Results in Table 2 denoted the vulnerability of different cattle breeds to tick infestation as the highest rate was recorded in Friesian (77.5%) followed by native and cross breeds (50.4 & 41.8% resp.). Moreover, B. annulatus was the predominant tick species affecting cattle (51.85%) followed by H. anatolicum & mixed infection (5.18% & 3.5% resp.). The obtained result was in coincide with that reported by Asmaa, 2012. However, Kabir et al. (2011) detected that prevalence of tick was significantly \((p < 0.01)\) higher in local cattle 103 (43.82%) than the crossbred 35 (24.13%) cattle.

Regarding tick infestation \((P)\) in different animal species across season of year (Table 4) revealed a significant increase \((P < 0.05)\) during summer months among examined cattle, goat & sheep (76.5%, 33.3% & 20.6% resp.,) as compared to (39.7%, 4.4% & 6.7 5 resp.,) meanwhile, infestation rate had not significantly differ in examined buffaloes in relation to season of year. These results go in accordance with those reported by Kabir et al. (2011) who found higher rate in summer (41.66%) followed by in winter season (31.5%). Similar studies were conducted by some other researchers in different countries.

5. Discussion and conclusions

The prevalence and distribution of tick infestation in different animal species as shown in (Table 1) revealed that (30.1%) of total observed animals were found tick infested with highest rate in cattle (60.5%) followed in order by goats (25.9%), buffaloes (17.8%), sheep (14.8%) and no infestation among camels. The most commonly prevalent tick’s species affecting ruminants in investigated locality was Boophilus annulatus (26.5%) followed by Hyalomma anatolicum (6.1%) then Rhipicephalus turanicus (3.4%). Moreover, B. annulatus was predominant tick species in cattle followed by H. anatolicum & mixed spp. (51.8%, 5.2% & 3.5% resp.,) meanwhile, H. anatolicum was prevailed in buffaloes (13.47%) followed by R. turanicus. In goat (23.1%).
Atif et al. (2012) concluded that highest prevalence of tick infestation was recorded in the months of June and July in all study districts and revealed that mean maximum temperature was significantly involved on month-wise prevalence of ticks in all study regions. Meanwhile, Stuti et al. (2008) reported that the animals were infested with ticks throughout the year, with maximum infestation during the rainy season then during summer and the least during winter. Sanjay et al. (2007) reported that tick infestation in cattle were higher in rainy followed by summer and winter, respectively. Rony et al. (2010) showed that, significantly (p < 0.001) higher seasonal prevalence occurred in summer season (78.46%), followed by winter (62.85%) and rainy season (52.11%). Generally tick population remains low during drought (Urquhart, 1996). The results showed that infestation rate was highest in summer season comparing to winter season. Khan et al. (1993) attributed an increase tick infestation during summer month’s due to an increase temperature and humidity.

The distribution (%) of tick infestation in different body parts of examined animals Table (5) revealed that the udder and external genitalia of examined cattle were the most predilection sites of tick infestation (70.7% of each) followed by animal’s neck & chest (63.0% of each), inner thighs (61.1%), perineum (41.7%), ears (14.6%) and around eyes (11.7%). Meanwhile in buffalo, the most infested parts were under the tail and premium (78.8%), udder & external genitalia (40.4%), thighs (27.6%), ears (17.0%), neck and chest (6.3%). In sheep and goat was around ear (87.5% & 60.8% resp.), followed by inner thigh in sheep (18.7%). These results may be attributed to that 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). Moreover, Atif et al. (2012) found 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.

Comparing the mean of tick infestation rate among cattle in both control and treated groups (TG) at the end of study (Table 6) revealed a highest infestation rate was in control group (14.6) followed by those in both TG (1 & II), (5.4 & 5.2 resp.) then cows in TG (III) (2.8) with the lowest rate in TG (IV) (0.4) where animals were treated with Ivermectin (0.2 mg/kg b.wt, S/C) in association of spraying of surrounding environment by Deltamethrin (1%) twice. Moreover, comparing the tickicidal efficacy of different four treatments indicated that cure rate was statistically significant (P < 0.05) in TG (VI) then TG (III) while no significant differences appeared in between animals in TG (I & II). Works in other regions also showed low levels of efficacy for this class of acaricide. Leite et al. (1995) detected 51.65% of efficacy level for deltamethrin. However Merlini and Yamamura, (1998) recorded higher averages for deltamethrin was 74.58% and in Ilheus, BA, was (65.04%) Campos Junior and Oliveira (2005). The emergence and spread of resistance to organophosphate occur faster than pyrethroids Foil et al. (2004). Moreover, (Pereira, 2006) reported efficacy for deltamethrin, of (25.39%) in Vale does Paraiba, The results showed that the poor husbandry practices of small holder farmers may be a determinant making the animals more prone to tick infestation in this district. Improving of hygienic measures accomplished with intensive treatment of both infested animals with (Ivermectin 0.2 mg/kg b.wt, S/C) adjunct to Deltamethrin (1%) to the surrounding environment at 14 days intervals are advisable for tick control under field conditions.

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