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Full Length Research Paper

Efficacy trial on susceptibility of *Amblyomma* ticks for commonly utilized acaricides in North Gondar

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Ticks are blood feeding ectoparasites that induce huge production losses in livestock industry and creating serious public health problems in the world. This study was conducted to assess the efficacy of commonly used acaricides against *Amblyomma variegatum* ticks in North Gondar. The assessment was conducted in laboratory and in the field. For laboratory experiment, adult ticks were collected and exposed to Amitraz or Diazinon. For live animal experiment, sheep infested naturally with *A. variegatum* ticks were kept in door and grouped into three. The first group was treated with Diazinon, the second group with Amitraz, and the last was left untreated as control. In the laboratory, significant difference (P > 0.05) was not observed between two acaricides on the killing effect at different concentrations. On live animals, there was a significant (P < 0.05) difference between two drugs. More ticks were died in Amitraz treated group than sheep treated with Diazinon. In conclusion, the two acaricides were performing almost equally in the laboratory but Amitraz was better on live animals. To confirm the presence of resistance on live animals, further studies using standard products are needed.

Key words: Acaricides, *Amblyomma* ticks, efficacy, North Gondar, susceptibility.

INTRODUCTION

Tick and tick born diseases (TBD) are widely distributed throughout the world particularly in tropical and subtropical countries, which cause tremendous economic losses in livestock production (Kettle, 1995). The economic losses caused by tick and TBD in cattle alone are estimated at 13.9 to 18.7 billion United States dollar annually worldwide (de Castro, 1997).

The problem is severe in developing countries where the resource for control and eradication is very limited (FAO, 1984). In most parts of Africa, including Ethiopia tick and TBD are economically very important. In Ethiopia, ticks occupy the first place among the external parasites and the economic loss incurred when they infest livestock, particularly cattle is enormous (Solomon et al., 2001).

Ticks are obligate ectoparasites of most types of terrestrial vertebrates. They are large mites and thus are arachnids, members of the subclass Acari. Tick bites, in addition to causing irritation and infestation, have been implicated in the transmission of serious diseases of livestock such as cowdriosis, babesiosis, anaplasmosis and others. These diseases are important causes of morbidity and mortality in livestock. By creating different grade of lesions on the skin, ticks down grade the quality

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of hides and skins up to 20 to 30%. They also predispose animals to secondary attacks from other parasites such as screw worm flies and infection by pathogens like *Dermatophilus congolensis* and other bac-terial diseases (Seyoum, 2001; Ghosh et al., 2007). Over 60 tick species are reported in Ethiopia. Especially, *Amblyomma* species are widely distributed and the most economically important ticks since they are known to transmit a fatal disease of domestic and wild ruminants in sub-Saharan Africa (heartwater) (Mekonnen, 1998). *Amblyomma* ticks are large; with three host parasites and long mouth parts which cause serious wounds (Fraser and Mays, 1991).Ticks are controlled by the application of acaricides to the body of the animal. Major chemicals used for this purpose are organophosphates, amidines, and synthetic pyrithroids. Some other compounds (chlorinated hydrocarbons and arsenicals) were used but phased out of the market mainly due to the development of tick resistance (Mekonnen, 1998).

In Ethiopia, acaricides are well utilized for the control of ticks, majority of these chemicals are utilized for two or three decades and it is also common to use acaricidal solutions too frequently at a lower concentration than recommended. All these promote the development of tick resistance against acaricides (Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP), 2010). Different acaricides are imported at the present without proper efficacy test, control and registration (Federal Environmental Protection Agency (FEPA), 2004). The purchase of acaricides by hard currency causes a major drain on the limited foreign exchange available in the country. Farmers and customers utilizing acaricides have complained about their effectiveness to kill or remove all ticks after application.

Moreover, the information about the efficacy of commonly utilized acaricides (Amitraz and Diazinon) on *Amblyomma* ticks in North Gondar zone is limited. Therefore, the objective of this study was to assess the efficacy of commonly used acaricides (Amitraz and Diazinon) against *Amblyomma* species of ticks in the area.

MATERIALS AND METHODS

The study area

The study was conducted from November, 2011 to June, 2012 in North Gondar, at latitude, longitude and altitude of 12.3 to 13.8 North, 35.3-35.7° East and 2,200 meter above sea level, respectively. The rainfall varies from 880 to 1772 mm Hg. The annual mean minimum and maximum temperature of the area varies between 12.3 to 17.7 and 22 to 30°C, respectively. The area has two seasons, the wet season from June to September in which the area gets its majority of rainfall, and the dry season from October to May which receives small and erratic rainfall (central statistical Authority (CSA), 2011).

METHODOLOGY

For laboratory experiment, unattached adult *Amblyomma* ticks were collected on the field and exposed to acaricides (Amitraz and Diazinon). The recommended (1:1000 for Diazinon, 1:625 for Amitraz), double (2:1000 for Diazinon, 2:625 for Amitraz) and half doses were prepared.

One ml of each liquor was added on Petri dish with a filter paper fit at its bottom. Then, the acaricide was evenly distributed and 10 ticks of equal size were placed on each Petri dish and it was closed.

Distilled water was used as a control. The number of ticks live or dead was counted after 24 h of exposure. The experiment was repeated three times for precision. For field trial, sheep infested naturally with *Amblyomma* ticks were kept in door and grouped into three containing five animals in each group. The first group was treated with Diazinon, the second group was treated with Amitraz, and the last group was left untreated as control. Acaricides were sprayed manually by giving more emphasis on tick infested areas. The acaricides' concentration was based on the manufacturer's recommendation for hand spray (1:1000 for Diazinon, 1:625 for Amitraz). The effects of acaricides on ticks were observed after 24, 48 and 72 h of exposure.

Data analysis

The data were recorded in excel spreadsheet. Descriptive statistics (mean, percentage and graphs) were used to express the results. Independent t-test was used to assess the difference between treatment groups. Statistical analysis was performed by using statistical package for social sciences (SPSS) version 19 and P value less than 0.05 was considered significant.

RESULTS

In laboratory

Figure 1 shows that a number of tick died after exposure with acaricides in laboratory at double, recommended and half doses. There was no significant difference ($P > 0.05$) between two acaricides on the killing effect in three different concentrations. The average number of ticks died after distilled water exposure was not more than one.

On live animals

The recommended doses of acaricides were applied on infested live animals. There was a significant ($P < 0.05$) difference between the two drugs. More ticks died in Amitraz treated group than sheep treated with Diazinon (Table 1). In addition to this, it was also observed that more dead ticks were not detached and more engorged ticks were observed in sheep treated with Diazinon.

DISCUSSION

The laboratory result showed absence of significant

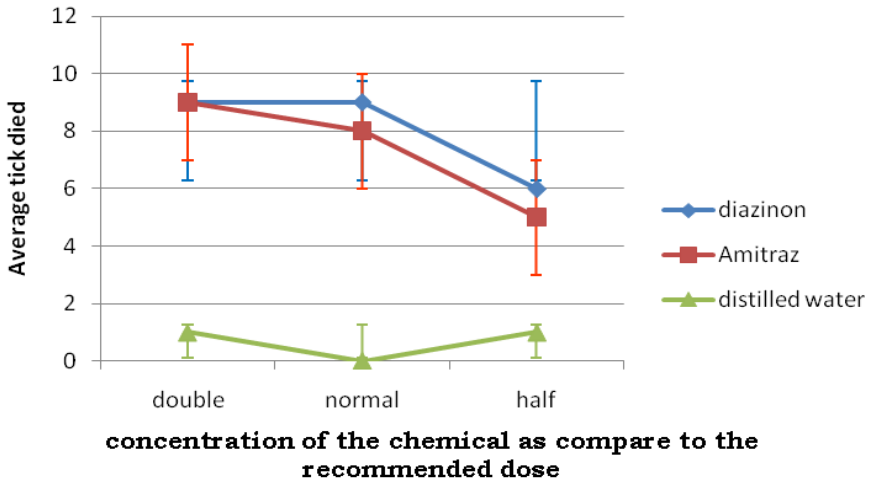

Figure 1. Killing effect of acaricides in the laboratory at double, recommended and half doses.

Table 1. Average tick count before and after treatment in different time interval.

S/n	Group	Average counts			
		Before treatment	After treatment		
			24 h	48 h	72 h
1	Group I (Diazinon)	39	27	14	12
2	Group II (Amitraz)	33	2	1	0
3	control	41	41	40	38

difference between two drugs on killing effect. However, on live animal, Amitraz was more effective than Diazinon. The difference in the result of the laboratory and on live animal may be related with different confounding factors on live animals. Significant proportion of ticks were not dead rather a lot of engorged ticks were observed in Diazinon treated group of sheep. The presence of engorged ticks in Diazinon treated group showed inability of the acaricide to inhibit growth and reproductive capacity of the ticks. This may be related to the decrease in the susceptibility of the tick for Diazinon. Such phenomenon was also complained of by livestock owners in the area. This finding is in line with report of Turkson and Botchey (1999) who reported that field strain of *Amblyomma* is resistant to organophosphates like Diazinon. Emergence of resistant tick against organophosphates acaricides was also stated by Tessema and Gashaw (2010). Eshetu et al. (2013) compared the efficacy of Amitraz and Diazinon on *Amblyomma* and other ticks and found that Amitraz at recommended concentration provides better efficient oviposition inhibition than Diazinon which agrees with the finding of this study.

The frequency of application of acaricides, dilution rate, storage as well as the quality of the product will affect the effectiveness of an acaricide (Turkson and Botchey, 1999).

The efficacy of Amitraz was compared with cyfluthrin, fipronil and permethrin by Burridge et al. (2003) on *Amblyomma* ticks in United States and found that Amitraz was less effective than others. However, Amitraz is an important acaricide because it does have some valuable properties for tick control. Amitraz has been shown to be an excellent detaching agent, inducing the rapid detachment of live ticks from infested animals (Mekonnen, 2001; Natala et al. 2005). However, some studies have shown that Amitraz can take several days to kill ticks and that some surviving ticks can complete engorgement and lay viable eggs. It is for these reasons that Amitraz is an acaricide useful for tick control but not for tick eradication (Burridge et al., 2003). However, still Amitraz is preferable than Diazinon in inhibiting oviposition (Eshetu et al., 2003). Cyfluthrin, fipronil and permethrin were not

utilized in North Gondar for the control of ticks (Melaku, 2013) and can be used alternatively with other acaricides to reduce the emerging of drug resistance.

Conclusion

In the laboratory, two acaricides were equally performing but on live animals, Amitraz was preferable than Diazinon. Other types or group of acaricide should also be used rather than depending on limited type of acaricides.

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