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Methods for tick control in livestock

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ABSTRACT

Ticks are the biological vectors of various veterinary diseases. They are one of the major threats to livestock health and productivity by transmitting various infectious organisms and causing economic losses. This article focuses on highlighting the importance of various tick control methods, involving the advantages and limitations of chemical, biological, and integrated techniques. Chemical acaricides are considered the most effective method for tick control, but they have risks and side effects that ultimately contribute to the need for sustainable alternatives. Biological control methods include environment-friendly techniques like the use of natural predators and pathogens. Integrated tick management (ITM) combines multiple control methods, providing a comprehensive approach to tick control. In addition, ethnoveterinary practices use traditional plant-based methods for tick control. This article concludes that a comprehensive understanding of a tick's biology is important for developing effective control strategies, which should be an approach having minimal risks, maximum benefits, and environment friendly.

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Introduction

Ticks are defined as obligatory ectoparasites which are more related to spiders than to insects [1]. There are approximately 800-900 species of ticks that are blood-sucking in all their feeding stages. Ticks transmit a greater variety of infectious organisms than other arthropods. There are four developmental stages in ticks' life cycle including eggs, larva, nymph, and adult. As their life cycle contains incomplete metamorphosis. Larva of ticks have 3 pairs of legs while nymphs and adults have four pairs of legs characteristics. Tropical and sub-tropical species of ticks may undergo one, two, or rarely three complete life cycles annually. At lower altitudes, where the temperature is high, most ticks require one cycle annually while at higher altitudes, where the temperature is low, 2-4 years are required by most species of ticks for a single cycle. Argasidae and Ixodidae are the two families of ticks that can parasitize livestock. They are also referred to as soft ticks and hard ticks, respectively. These species of ticks can survive months or even years without food if the conditions are permitted. Ticks are also termed biological vectors of certain diseases, as they include the life cycle of parasites.

Ticks affect ruminants, livestock, and humans in all parts of the world. Ticks induce great impact on livestock economy in tropical and sub-tropical regions as they feed on these organisms and reproduce in high numbers which ultimately contributes to factors like anemia and blood-sucking, transmission of pathogens and zoonotic diseases, and the development of resistance to drugs used for the control of ticks. Ticks are well-known for various diseases, including Lyme disease, anaplasmosis, babesiosis, and ehrlichiosis. These diseases lead to symptoms like fever, anemia, lethargy, and even death. For instance, bovine anaplasmosis, caused by the bacterium *Anaplasma marginale*, results in severe weight loss and decreased milk production. To control such diseases, tick control methods are crucial in preventing health issues, and ensuring that livestock maintains their productive capacities.

It is estimated that the cost of damage, control, and prevention has exceeded a thousand million dollars annually. Most of the veterinary losses arise from decreased productivity and increased veterinary expenses. Studies have shown that ticks-borne diseases lead to magnificent financial losses. These costs include treatment expenses, loss of livestock market, market value, and low production rate.

Control methods

Effective tick control methods play a significant role in maintaining the health and productivity of livestock. These effective methods include chemical treatments, biological strategies, and integrated pest management approaches. By utilizing a combination of such techniques, a farmer can effectively control tick populations, reduce the chances of tick-borne diseases and disease transmission, and enhance the overall welfare of animals. The following gives the effective methods for controlling ticks:

1. Chemical ticks control methods

Chemical agents are widely used in livestock for tick control as they have an immediate and potent effect on the body of cattle. These chemical agents are termed as acaricides. There are several types of acaricides. Depending on their active components and mechanism of action, they may be divided into several groups, such as

I. Carbamates and Organophosphates: These cause the paralysis and death of ticks by blocking acetylcholinesterase enzyme. Carbaryl and dichlorvos are two examples [2].

II. Pyrethroids: These artificial substances, which are derived from natural pyrethrins, cause hyperexcitation as well as death in insects by acting on their neurological systems. Common examples include permethrin and cypermethrin [3].

III. Macrocyclic Lactones: These work well against parasites, both internal and external. Examples of common treatments for mites, along with ticks, are moxidectin and ivermectin. These chemical agents interfere with neurotransmission in ticks, leading to death [4].

IV. Neonicotinoids and Spinosynsv: These cause nervous system failure in pests by targeting their nicotinic acetylcholine receptors [5].

Chemical-based acaricides are effective, but they must be handled cautiously to prevent animal toxicity and the development of tick resistance. The selection of acaricides depends upon various factors like the type of livestock, the environment of livestock, and the species of tick. The effectiveness of these chemical agents depends upon their proper application. To be effective against ticks, there are various techniques, like spot treatments, dipping vats, pour-ons, and sprays. Spot treatments involve direct application to specific areas of the animal, while with dipping vats animals are submerged in a chemical solution. Whereas pour-ons are liquid formations that are applied on the animal's back and sprays involve covering all the body surfaces.

Besides their effectiveness against ticks, acaricides may come with risks and side effects. Persistent use can cause acaricide resistance, which ultimately causes it to be difficult to stop ticks. Adverse reactions such as skin irritations; skin allergy or systemic toxicity can occur in livestock and the chemical residues left can contaminate the environment. To eliminate these risks, it is important to follow the recommended proper guidelines, substitute the acaricide kinds, and integrate chemical control with other tick management strategies.

2. Biological Tick Control Approaches

The biological control method involves the use of natural predators and pathogens for the reduction of tick populations [6]. Predators of ticks like beetles, spiders, and guinea fowl play an important role in controlling the ticks' populations. Similarly, the tick-eating beetle's larva prey on the eggs and larvae of ticks. In addition, certain nematodes and fungi are natural pathogens of ticks as they infect and kill them upon contact. By using the natural predator technique, we cannot only manage tick populations but also maintain our environment without relying on chemical acaricides. Biological methods neglect dependence upon synthetic chemicals and minimize the risk of acaricide resistance and environmental contamination. Biological methods can significantly be used in integrated management, creating a broad spectrum for tick control. In short, biological control contributes to long-term tick management strategies.

Besides the advantages of biological control, it also contains some limitations and challenges. The accuracy of natural predators varies in environmental conditions and tick species. In addition, it is also a major challenging task to maintain the population of predatory organisms. Biological control efforts can be disturbed by factors like climate, habitat availability, and other predators. Such techniques require more period to

achieve successful results. To overcome such challenges, a descriptive understanding of ecosystems and careful planning strategies are required for successful implementations.

3. Integrated Tick Management control

Integrated tick management involves the combination of all possible ways like chemical, biological, and cultural methods to achieve sustainable tick control [7]. This strategy reduces the dependence on chemical acaricides and reduces the chances of resistance and environmental contamination. For instance, combining periodic chemical treatments with the release of natural predators will effectively contribute to the proper management of tick populations. ITM strategies are tailored to specific farm conditions, considering factors such as livestock type, tick species, and environmental conditions.

4. Ethnoveterinary practices for ticks' control

Ethnoveterinary practices involve the use of ethnoveterinary plants, which are mostly used for the treatment of livestock sickness including ticks and tick-borne diseases in rural areas. These practices are inexpensive and are mainly based on the use of daily available resources. Using traditional plant-based ectoparasite control methods in the primary health care of livestock is increasingly becoming an important intervention for improving livestock productivity in resource-challenged smallholder farming areas because of availability and low prices. Several plants have shown growth-inhibiting, antimoulting, and repellent properties against ticks [8]. Alcoholic extracts of the sugar apple plant (*Annona squamosa)* and neem (*Azadirachta indica*) have shown comprehensive anti-tick insecticidal results [9].

Futuristic tick control

In the future, it is most likely that tick control will be focused on developing more sustainability and effectiveness in methods. By utilizing genetic engineering, one can develop tick-resistant breeds of livestock which will contribute to the neglect of chemical treatments. In addition, we can generate targeted biological agents like genetically changed predators and pathogens using advancements in biotechnology. By using innovative tools of farming such as remote sensing and data analytics, a farmer can enhance monitoring and assessment capabilities with more ease. These innovations contain the abilities to bring the revolution in tick livestock management.

Conclusion

In conclusion, it is mandatory to use effective methods against ticks to maintain the health and production of livestock. Ticks are responsible for enormous health risks and can lead to significant losses in the livestock industry. Chemical acaricides are the most effective, but they come with potential risks and side effects which ultimately demand integrated tick management approaches involving the combination of chemical, biological, and cultural methods. The future of tick control management is likely to be pointed towards genetic and biotechnological advancements. By applying a broad and integrated approach to tick control, one can ensure the health and productivity of the animals and ultimately support the economy of the operation.

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