



Application of an Insectoacaricidal Preparation Based on *Anabasis aphylla* for the Protection of Animals against Ectoparasites Using an Automated Spraying Method

Lider Lyudmila* ¹, Yeszhanova Gulzhan¹ , Uskenov Rashit¹ ,
Bostanova Saule ² and Mamytbekova Gulnur

¹NJSC S. Seifullin Kazakh Agrotechnical research University, Astana, 62 Zhenis Avenue, 010000, Kazakhstan

²LLP «Kazakhstan Technology Commercialization Center», Astana, 63 Abay street, 010000, Kazakhstan

l.lider@kazatu.kz

Abstract. This study examines and characterizes the species composition of ectoparasites infesting cattle maintained at the “North Kazakhstan Agricultural Experimental Station” and assesses the prevalence of arachnoentomosis during the spring–summer period through calculation of the abundance and occurrence indices. For the first time, an insectoacaricidal preparation derived via pyrolysis of plant fiber incorporating *Anabasis aphylla* was employed under pasture conditions to protect cattle from ixodid ticks, dipterans, and the biting louse *Bovicola bovis*, using an automated spraying system. The study established the optimal application parameters for the insecticidal preparation and evaluated its influence on the clinical health indicators of the animals.

Keywords: Ectoparasites, Cattle, Plant-Based Insecticides, *Anabasis Aphylla*, Automated System.

1 Introduction

Parasitic diseases pose a significant threat to the health of livestock and have a substantial negative impact on the economic performance of animal husbandry. Infestation with ectoparasites is accompanied by the development of dermatitis, anemia, chills, bacterial and viral infections, tick-borne fever, and increases the risk of transmission of pathogens responsible for several dangerous diseases. In this regard, measures aimed at controlling ectoparasite populations represent a key aspect of veterinary prevention. Over the past five decades, chemical acaricides have been widely used for their control. However, current challenges include issues related to the residual effects of these

agents, their side effects, and the development of resistance in parasites, which necessitate the creation of safe and highly effective insectoacaricidal agents [1,2,3].

Plant-derived raw materials are a promising source of biologically active compounds due to their environmental safety and diversity of metabolites with antiparasitic activity. For example, the essential oil of *Curcuma longa* exhibits pronounced acaricidal properties against the cattle ectoparasitic tick *Rhipicephalus (Boophilus) annulatus* and is characterized by insecticidal, anti-inflammatory, and antioxidant effects, as well as the ability to repel a wide range of pests [4].

The species *Tagetes patula* (family *Asteraceae*) contains significant amounts of flavonoids, thiophenes, and terpenes, which determine its high insecticidal and acaricidal activity [5].

On the basis of the liquid-phase phytocreolin substance (Patent of the Republic of Kazakhstan for a utility model No. 4794) with the addition of a dry extract of *Anabasis aphylla*, a pharmacologically active, non-toxic bioproduct with insectoacaricidal and repellent properties was developed [3]. Similar studies are consistent with current evidence indicating that plant extracts may exhibit pronounced acaricidal activity against ixodid ticks, including *Rhipicephalus (Boophilus) microplus* [6]. Furthermore, recent reports confirm the potential of natural compounds in tick control as an environmentally safe alternative to synthetic agents [7].

For our study, an automated Smart-spraying system was employed. The automated Smart-spraying system, developed at S. Seifullin Kazakh Agro Technical University, ensures uniform distribution of the working solution over the animal's hair coat [8,9,10]. The structural features of the device, including optimization of nozzle spray angles and consideration of the animal's anatomical position, enable complete coverage of the treated surface and high procedural efficiency (Figure 1).

The aim of this study was to evaluate the effectiveness of a plant-based insectoacaricidal preparation applied via an automated spraying device for treating cattle infested with ectoparasites under pasture conditions.



Fig. 1. Treatment of animals with the preparation using the Smart system during watering.

2 Materials and Methods

The study was conducted from May to August 2025 in the North Kazakhstan Region, Akkayin District, Shagaly Rural District (North Kazakhstan Agricultural Experimental Station) on Kazakh Whiteheaded cattle.

A total of 140 head of cattle underwent a preliminary clinical examination and were inspected for the presence of ectoparasites by examining the skin of the head, neck, back, sides, abdomen, and limbs. The inspection was carried out visually and with the aid of a magnifying glass. Samples were delivered to the laboratory of the Department of Veterinary Medicine for identification of the ectoparasite species composition.

The abundance index (AI) and occurrence index (OI) of ectoparasites were then calculated. The abundance index was defined as the average number of individuals of a given species (or group of species) per sampling unit. The occurrence index was expressed as a percentage, calculated as the ratio of the number of samples in which individuals of the target species were detected to the total number of samples analyzed.

The treatment preparation was developed in collaboration with the “Zhalyn” scientific and Production Technology Center (Almaty, Kazakhstan). Its active components consisted of a mixture of rice husk tar, phenol, cresol, phenolic acids, and anabasine, with water serving as the carrier.

The basis of the preparation was a phytosubstance obtained by pyrolysis of a liquid-phase substance derived from rice husks. The resulting product was an oily dark brown liquid with a characteristic odor. The biomass of rice husks contains phenol (0.7%) and cresol (0.5%) of the total volatile matter content.

Anabasine, included in the composition of the preparation, is used as an insecticide, mainly in the form of anabasine sulfate obtained from the plant *Anabasis aphylla*. This is a clear dark brown oily liquid, readily soluble in water; the content of pure anabasine in the aqueous solution of the preparation reaches 40%. Anabasine sulfate penetrates slowly through intact skin, exerting mainly a superficial effect. The toxicity of the substance depends on its concentration and the degree of dilution of the working solution. At a concentration of 0.1–0.3%, when applied by spraying, the preparation is safe for animals and effective against ectoparasites. The developed preparation underwent pre-clinical toxicity testing. Throughout the entire period of its application, animals were subjected to clinical observation.

Statistical analysis of the obtained data was performed using Microsoft Excel and Statistika+2003 software packages.

3 Results

The insectoacaricidal efficacy of the developed formulation under pasture conditions in cattle was evaluated against ixodid ticks (*Haemaphysalis spp.*, *Dermacentor spp.*,

Hyalomma spp.), dipteran insects (*Musca spp.*, *Culex spp.*, *Simulium spp.*, *Tabanus spp.*), and chewing lice (*Bovicola bovis*).

The study included 140 cows of various ages. Animals were treated by spraying using an automated device, at a dose of 500 ± 100 mL of the formulation per animal.

Infestation assessment was conducted on days 7, 14, and 21 post-treatment. During the examination, the presence of ixodid ticks was recorded, and the occurrence of dipteran insects on the skin and hair coat was determined. The clinical efficacy of the formulation was established based on the calculation of the abundance index (AI, specimens per recording unit) and the occurrence index (OI, %).

Pasture flies (*Musca spp.*) were recorded during daylight hours, predominantly on the head, neck, back, flanks, abdomen, and limbs. AI values ranged from 0 to 0.7 specimens per recording unit, and OI from 0 to 20%.

Bloodsucking mosquitoes (*Culex spp.*), blackflies (*Simulium spp.*), and horseflies (*Tabanus spp.*) were found on the entire body surface throughout daylight hours. The AI of mosquitoes ranged from 0 to 4.3 specimens, with an OI of 100% in summer. For blackflies, AI also ranged from 0 to 4.3 specimens, with an OI of 100%. For horseflies, AI ranged from 0 to 3.5 specimens, with an OI of 0–33%. Throughout the pasture season, chewing lice (*Bovicola bovis*) were recorded, causing pruritus, restlessness, alopecia, and weight loss. Parasites were found on the head, neck, back, and abdomen. AI ranged from 8.6 to 11 specimens, and OI reached 100% in the spring–summer period. Ticks of the genus *Dermacentor* were detected on the neck and ventral body regions. AI ranged from 1.2 to 3.2 specimens, and OI from 25 to 35% (Figure 2).

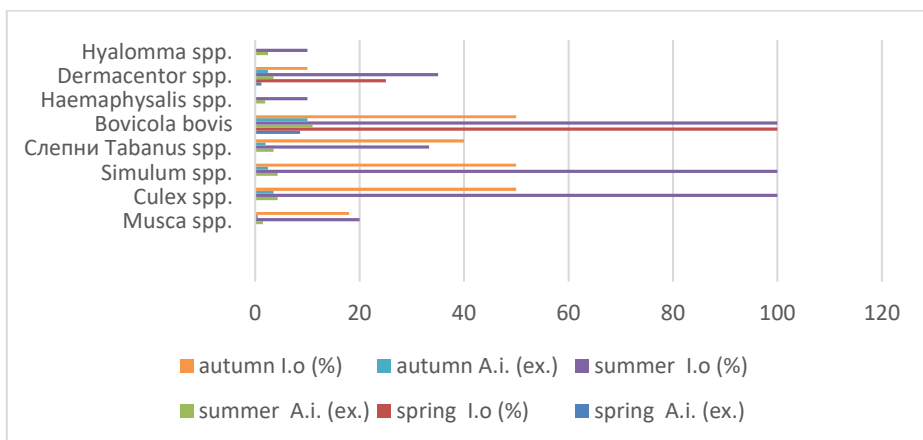


Fig. 2. Species composition and infestation rate of ectoparasites in cattle during different seasons of the year

Field trials were carried out by spraying the skin surface of cattle with a working solution containing 0.2% of the active substance. Before application, the insectoacaricidal preparation was diluted with water to the required concentration. The working solution was prepared by mixing a pre-measured volume of the preparation with water in the tank immediately before use, at a ratio of 0.5 L of the preparation per 10 L of water. The consumption of the working solution per animal was 500 ± 100 mL.

The duration of the effect of the developed insectoacaricidal preparation after a single treatment of the animals' body surface using an automated device was evaluated on days 7, 14, and 21 after application (Figure 3).

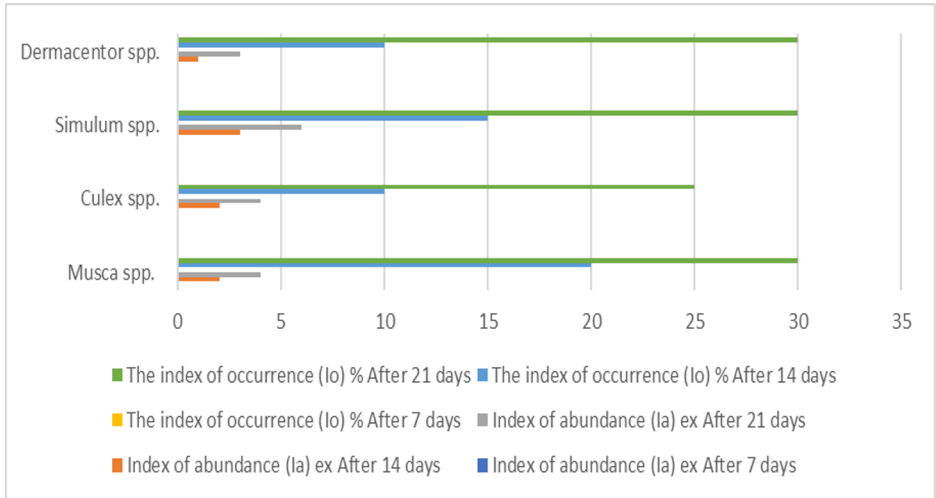


Fig. 3. Efficacy of cattle treatment with an insectoacaricidal preparation against ectoparasites

Analysis of the data presented in Figure 2 showed that the efficacy of cattle treatment against ectoparasites with the preparation containing anabasine, when applied using an automated device, was 85% during the first 7–14 days after spraying and remained at a high level of activity up to 14 days. On the 14th day after treatment, ectoparasite specimens were recorded on the animals' bodies. The highest occurrence index on day 21 was noted for blood-sucking mosquitoes *Culex spp.*, to a lesser extent for pasture flies *Musca spp.* and black flies *Simulium spp.* At the same time, the insecticidal efficacy against horseflies (*Tabanus spp.*) and biting lice (*Bovicola bovis*) persisted even after 21 days. The preparation also demonstrated high activity against ixodid ticks *Haemaphysalis spp.* and *Hyalomma spp.*

4 Conclusion

The formulation based on active substances obtained through the pyrolysis of plant fiber and containing anabasine ensures complete elimination of ectoparasites after a single treatment and maintains a protective effect for up to 14 days. The environmental safety of the preparation is attributed to the use of active ingredients of natural origin, which decompose into non-toxic compounds within a certain period after application. Regular medium-volume spraying of grazing cattle's hair oat with a 5% (active ingredient) aqueous emulsion of anabasine in phytocreolin for protection against ticks, pasture flies, and other blood-sucking insects provides not only immediate protection of the animals but also reduces the population density of flying dipterans and ticks on

pasture for 14 days, thereby shortening the period of mass infestation and reducing the need for repeated treatments.

The efficacy of the plant-derived insectoacaricidal preparation is comparable to that of synthetic chemical agents, while its use significantly reduces losses caused by insect and tick infestations. The developed product can be recommended to veterinary specialists of agricultural enterprises to ensure animal health and productivity under organic livestock production conditions.

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