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FULL PAPER

Insecticide efficacy of medicines and chemicals during cats flea infestations in Tyumen

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The study's main aim is to provide the results of therapeutic efficiency of Komfortis, Foresto and Fitoelita medical agents and chemicals used during flea infestation among domestic cats. To obtain the aim of the study, the animals were divided into three groups of which ten animals were included. Clinical, hematologic, and special research methods were conducted. Blood sampling included three stages: before insecticides treatment, the intermediate interval of 15 days, and the final stage. It is discovered that Komfortis and Foresto have 100% therapeutic efficacy at all stages of flea development and possess a long-lasting action during a flea infestation. The morphological blood analysis demonstrates that the proposed medical agents hold no toxic or side effects.

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Introduction

From time immemorial, people began to domesticate wild animals, and throughout many generations, they were kept by people genetically isolated from external pathogens [1-4]. At present, every pet owner is trying to breed and protect their animal from contagious and noncontagious diseases. However, the lack of knowledge and mass media on simple preventive measures results in widespread infectious and invasive diseases, including flea infestation among dogs and cats [5-7].

Flea infestation of domestic cats is one of the urgent problems studied by modern veterinary science. However, despite the achieved success of parasitic pharmacy in their elimination, fleas are widely spread and represent a danger to cats, dogs, and other house carnivorous animals kept in close contact, as well as owners and people contacting them [8-13].

To prevent the distribution of flea infestations, it is necessary to account for and ensure continuous epizootic control over timely medical and preventive measures to eliminate the focus of disease [14-20].

Today, veterinary science employs various anti-parasitic agents that differ in their form, chemical composition, mode of administration, and price. However, despite the variety of insecticidal agents created to fight against flea infestations, some current flea species are resistant to some classes of insecticides containing two and more active drug substances [11,18].

The resistance level may be high to exclude the possibility of any further use of either medical agent [21,22]. There are known cases when the resistance of parasitic arthropods is developed even when testing a new medicine prior to its industrial output [15,19,23].

In this regard, the efforts of experts are aimed not only at the creation of new

medicinal compounds with a different mode of action, but also at the search of such insecticide strategy, which could prevent the formation of resistant types of parasitic arthropods.

Thus, it is critical to develop new medical agents, mainly complex ones containing several active drug substances. This combination is advantageous since various active substances cause a synergistic impact on all stages of flea development.

Materials and methods

The current study was performed during 2014-2020 at a vivarium of the Institute of Biotechnology and Veterinary Medicine of the Northern Trans-Ural State Agricultural University. The experimental part was conducted at the laboratories of the All-Russian Research Institute of Veterinary Entomology and Arachnology - Branch of Tyumen Research Center, SB RAS, and the veterinary clinics of Tyumen.

Thirty animals were picked for the study (different breed, age, and nutritional state), and thus forming three equal groups (n=10).

Komfortis was applied to the first test group, Foresto – to the second, and Fitoelita shampoo – to the third control group.

Komfortis is an insecticide released as a pill for oral use; it contains spinosad – 53.33%, is active towards fleas parasitizing dogs and cats. The mechanism of action involves the activation of n-cholinergic receptors of parasitic arthropods, causing nervous strain, muscle cramps, tremors, and paralyzes leading to the death of insects [8].

Results and discussion

During the study, it was noted that Komfortis and Foresto have high insecticidal effects reaching 98-100%. The insecticide efficacy was considered within a month, every five days from the moment of applying for the medicines.

It shall be noted that the number of dead images was sharply increasing from the first to the tenth day of the study in test groups. The maximum mortality rate was on the 5th day of observations, where for the first group this made – 34.28%, and for the second – 29.30%. The number of fleas in test groups was reduced during the following observation.

The therapeutic efficacy of applied medical agents made 100% in the first group on the 25th day of observation and in the second group on the 30th day. The smallest number of parasites per one infected specimen was observed with Komfortis – 45.8.

The analysis of the insecticidal activity of the control group showed that the efficacy of the medical agent was indicated only at the time of drug administration; during the interim periods, the number of fleas was minimum, the maximum mortality rate was observed on the 20th day and made 18.24%.

The highest invasiveness per one specimen of the control group made 102.5, demonstrating the progressive growth of fleas at all control points. All results are indicated in Table 1.

The study of the therapeutic efficacy of Komfortis, Foresto, and Fitoelita during flea infestation of cats did not reveal any negative impact on their organism; there were no toxicoses and gastrointestinal upsets.

The hematologic study revealed that a minor increase of white blood cells was noted during the primary blood sampling among all groups of animals.

After the use of insecticidal agents, the follow-up tests were performed at interim intervals. The first and the second groups are characterized by the decrease of indicators to the minimum, while the control group–by the increase in leukocytes to 7.98 ± 0.41%, eosinophils to 2.68±0.46%, other indicators remained stable.

At the final stage of blood sampling from the groups exposed to Komfortis and Foresto, the animals were fully recovered, the blood values fell within the physiological range, the

indicators of the control group did not change drastically from the primary tests at the beginning of therapy. All results are indicated in Table 2.

The hematologic blood changes of cats with flea infestations show that the values do not change substantially from the physiological range at various invasiveness.

TABLE 1 Insecticide efficacy during cats FLEA infestation in tyumen

Assessment period	The first test group Komfortis agent (n=10)		The second test group Foresto collar (n=10)		Control group Fitoelita shampoo (n=10)	
	Amount of detected fleas	*%*	*Amount of detected fleas*	*%*	*Amount of detected fleas*	*%*
The 1st day	144	31.44±0.67	121	25.69±0.71	157	15.31±0.76
The 5th day	157	34.28±0.58	138	29.30±0.69	104	10.15±0.54
The 10th day	112	24.45±0.52	124	26.33±0.52	161	15.71±0.48
The 15th day	29	8.52±0.42	68	12.31±0.37	130	12.68±0.65
The 20th day	6	1.31±0.34	39	8.28±0.29	187	18.24±0.44
The 25th day	0	0±0.25	11	2.34±0.21	133	12.97±0.76
The 30th day	0	0±0.28	0	0±0.17	153	14.93±0.51
Total	458		471		1025	
Infection intensity	45.8		47.1		102.5	

TABLE 2 The main hematologic changes of blood during cats flea infestation in Tyumen

Indicator	Leucocytes, 109/l	Eosinocyte, %	Band neutrophils, %	Segmented neutrophils, %	Lymphocytes, %	Monocytes, %
Blood test at the beginning of study						
The first group Komfortis	7.61±0.41	2.38±0.45	2.41±0.38	37.68±1.26	31.87±0.29	2.13±0.33
The second group Foresto	7.64±0.44	2.42±0.38	2.40±0.21	37.62±1.62	31.81±0.25	2.15±0.39
Control group Fitoelita	7.55±0.39	2.44±0.42	2.40±0.21	37.65±1.64	31.86±0.28	2.12±0.38
Interim blood test on the 15th day						
The first group Komfortis	6.81±0.42	1.86±0.52	1.38±0.33	36.22±1.26	27. 45±0.34	1.61±0.35
The second group Foresto	6.93±0.38	1.97±0.49	1.42±0.36	36.28±1.28	28.16±0.32	1.89±0.29
Control group Fitoelita	7.98±0.41	2.68±0.46	2.14±0.31	37.15±1.12	31.64±1.12	1.64±0.32
Final blood test on the 30th day						
The first group Komfortis	6.24±0.51	0.82±0.34	0.28±0.12	35.46±0.66	26.14±0.29	1.25±0.31
The second group Foresto	6.28±0.49	0.86±0.42	0.34±0.15	35.51±0.69	26.17±0.26	1.54±0.28
Control group Fitoelita	8.14±0.53	2.74±0.38	2.15±0.22	37.02±1.16	31.42±1.24	2.49±0.29

Thus, the hematologic study made it possible to confirm that the treatment with such medical agents does not exert a pathogenic impact on blood values, which fall within the physiological range.

Foresto is an insect-acaricidal collar containing imidacloprid – 1.25 g and flumethrin – 0.56 g. The mechanism of imidacloprid action is based on the interaction with acetylcholine receptors of ectoparasites. It causes neurotransmission disorder resulting in complete paralysis leading to the death of ectoparasites. Flumethrin is a pyrethroid insecticide affecting voltage-sensitive sodium channels. It blocks nerve conduction resulting in spasms, causing motor reflexes of arthropods leading to death [9].

Fitoelita is an insecticidal shampoo. It contains permethrin – 0.3%, blocks neurotransmission of peripheral nerves ganglion leading to death through paralysis of flea adult and larval phases [10].

The following special methods were used: hair combing (to define the number of alive and dead fleas) (Figure 1), flea counting in Dawn Professional Dawn solution (Figure 2), microscopic study (to define flea viability) (Figure 3), and hair print using acetate bands (to detect fleas and products of their activity) (Figure 4). The obtained results were processed statistically via Statistica Ultimate Academic Bundle.

FIGURE 1 Collection of fleas and eggs during combing

The dosage of Komfortis pills was selected individually, taking into account the animal weight before treatment. Komfortis was applied at a dose of 50 mg/kg. The insect-acaricidal Foresto collar was used per cats' instructions (38 cm). The medical agents were applied once only for test groups. The insecticidal Fitoelita shampoo was used at the rate of 1 mL/kg, its application was repeated after ten days as per the manufacture's recommendations.

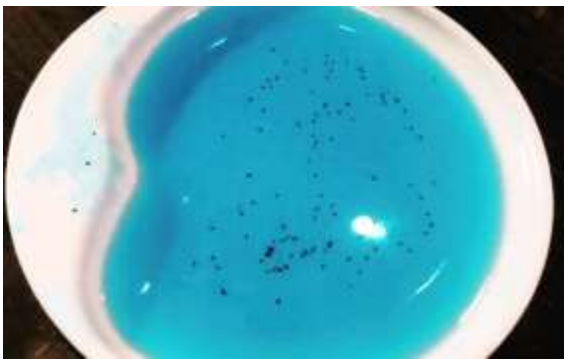

FIGURE 2 Ctenocephalides felis in Dawn Professional Dawn solution after combing

The efficiency of applied medical agents during flea infestations of domestic animals was assessed following the clinical, hematologic, the special trials results, and estimation of infestation intensity.

The blood tests were analyzed via the Abacus Junior 5 (Vet), sampling was done on the first day, further periods were broken into interim stages of 15 days.

The flea infestation was validated using the special study of hair and skin cover of all groups of animals before treatment and after the application of insecticidal medicines and chemicals.

FIGURE 3 Ctenocephalides felis under microscopic study

FIGURE 4 Hair print with Ctenocephalides felis

Conclusion

Overall, the study mainly intended to present the therapeutic efficiency results of Komfortis, Foresto, and Fitoelita medical agents and chemicals used during flea infestation among domestic cats. To do so, clinical, hematologic, and special research methods were utilized.

Based on the results obtained, the efficacy of using such insecticidal medical agents as Komfortis and Foresto collars as the therapy of cats' flea infestations makes 100%.

The application of such insecticides allows facilitating and reducing the length of treatment of pets.

After treatment, further observation of patients after treatment did not reveal any reinfestation cases, which indicates its long-term action and serves as an excellent preventive method.

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