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Evaluation of the Effect of Vetom 1 in the Treatment of Knemidocoptes in Budgerigars

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Abstract: In budgies, the most common ectoparasite is the mite *Knemidokoptes mutans*, which causes the disease Knemidocoptosis. The motivation of our study is to study the microbiota of the peri-cloacal region of budgerigars as a factor in changing the convalescence of basic and concomitant symptoms in the treatment of knemidocoptosis of budgerigars with the use of probiotics. We investigated the effect of the probiotic preparation Vetom 1 on the microflora's quantitative composition of the peri-cloacal area of budgerigars. The drug's effect impacted the dynamics of convalescence of individual symptoms and their correlations in the complex therapy of Knemidocoptes, accompanied by digestive disorders. The product contains one $\times 10^6$ CFU/g of *Bacillus subtilis* DSM 32424. The poultry groups were supplemented with Vetom 1 at 50 mg/kg body weight daily for ten days. The experimental and control groups were treated with a 0.05% "Aversectin" ointment on the areas affected by Knemidocoptes and Ringer-Locke and Vitam solutions intramuscularly. It was established that the biotic preparation of Vetom 1 shortens the convalescence period of the diarrheal syndrome in budgerigars during the treatment of Knemidocoptes. Vetom 1 does not affect the duration and rate of convalescence of desquamative perinasal dermatitis of budgies. Vetom 1 modulates the microbiocenosis of the pericloacal area.

Keywords: Agriculture, Bifidobacterial, Budgerigars, Desquamative Dermatitis, Diarrheal Syndrome, Vetom 1

Introduction

Knemidokoptosis (scabies) is an acute and chronic disease caused by the mite *Knemidokoptes mutans*, belonging to the order Acariformes. Wavy parrots often have knemidocoptosis (parrot scabies). In other parrot species, this disease is rare. With a high degree of infection with a mite, a fatal outcome is possible. Knemidocoptosis is transmitted from a sick bird to a healthy one when kept together in an aviary. Chicks and weakened birds are most at risk of infection.

The disease is characterized by lesions of the skin of the legs, the step, the cloaca, and the heads of birds. At the same time, spongy growths form in the area of the wax, in the hollows of which mites can be seen. If the disease is not treated or treated, but incorrectly, then it is possible to develop a deformity of the beak (Ankudinova, 2022).

In addition to the characteristic lesion of the legs, there is also a form of knemidocoptosis, the causative agent of which is the mite *K. gallinae*. This species parasitizes the skin of birds, which is accompanied by itching, pecking, loss of feathers, and the formation of nodules on the skin of a sick bird (Fomo and Katayeva, 2019).

Secondary bacterial infection is a constant companion of animals' viral and parasitic diseases, including birds (Nozdrin *et al*., 2018; Elenshleger *et al*., 2019). The rapid spread of bacterial infection is facilitated by the bird's anatomical and physiological characteristics. The appearance of a pathological focus on the mucous membranes can have consequences throughout the body, including the gastrointestinal tract (Yosi *et al*., 2017). The complex therapy of parasitic diseases should be accompanied by monitoring of the gastrointestinal tract's functional state for the presence of bacterial infections (Dzhafarov *et al*., 2010; Plys, 2017; Zhanabayev *et al*., 2022).

Traditionally, antibiotics and synthetic chemotherapists are used to treat diseases of the gastrointestinal tract. However, these chemical substances are toxic, as are antiparasitic agents (WHO,

2014). As a result, their combined use can negatively affect the animal's body and cause various complications. In this case, it is necessary to look for new safe drugs for animals that, in combination with other drugs, will not harm the animal's body. This class includes probiotics (Nozdrin *et al*., 2015; Alikin *et al*., 2018; Smolovskaya *et al*., 2023).

Probiotics have a pronounced synergistic effect on *Lactobacilli* and *Bifidobacteria* useful for the body and have an antagonistic effect on pathogenic and opportunistic microflora (Tarakanov, 2000). Under the influence of probiotics, metabolic processes are activated, and the synthesis of various biologically active substances: Vitamins, polypeptides, enzymes, etc. (Dylag *et al*., 2014; Valoshin and Glazkov, 2022). Probiotics alter the biosynthesis processes of endogenous serotonin, which affects the activity of the central nervous system, as a result of which the anxiety of the animal under stress conditions decreases (Savchenko *et al*., 2020).

However, the study of the effect of probiotic drugs in the treatment of specific nosologies, including micro-biocenosis of the gastrointestinal tract, remains poorly studied in veterinary medicine.

We aimed to investigate the microbiota of the peri-cloacal area of budgerigars as a factor in the change in the convalescence of primary and accompanying symptoms when using bacilli-containing probiotics in the treatment of Knemidocoptes.

Materials and Methods

The protocol of the study was discussed and approved at the meeting of the local ethical committee of the Novosibirsk State Agrarian University of the ministry of agriculture of the Russian federation on October 12, 2020.

The scientific experiment was conducted based on Novosibirsk State Agrarian University, Novosibirsk in the period from October 12 to November 12, 2020. Groups of budgerigars were selected from one breeder of budgerigars. The bird was kept in aviaries for parrots in the laboratory of Novosibirsk State Agrarian University. Laboratory conditions correspond to the zoohygenic conditions of growing this type of ornamental bird. The humidity in the room was within 65%, the temperature regime was about 22°C.

We based on analogs formed an experimental and control group of budgies at 10 months of age, ten heads each, infected with *Knemidocoptes pillae* at the same stage of the pathological process in the perinasal area. The birds were kept by the European Convention for the Protection of Vertebrates (Karkishchenko and Grachev, 2010). The experimental and control groups' animals were treated with 0.05% "Aversectin" ointment on the areas affected by Knemidocoptes, and intramuscular injections of ringer-Locke and Vitam were performed. The experimental group was also injected with the probiotic Vetom 1 orally at a dose of 50 mg/kg daily for ten days.

The budgies' physiological state was determined daily: The presence of diarrheal syndrome and desquamative perinasal dermatitis. The birds were swabs from the peri-cloacal area to assess the micro-biocenosis of the gastrointestinal tract.

In the laboratory, inoculation of washes on many elective and differential media was carried out. To determine the number of enterobacteria, we used a dry Gissa-GRM nutrient medium with lactose to TI (Technic Instructions) 9398-049-78095326-2008. According to TI, the number of *Lactobacilli* was determined with a nutrient medium for the isolation, counting, and cultivation of *Lactobacilli* dry MRS agar semi-liquid modification 9385-235-78095326-2016. A *Blauroccus* nutrient medium concerning the requirements of ML 7895326-039-2012 was used to determine the number of *Bifidobacteria*. The number of *Corynebacteria* in the meat-peptone broth that meets the needs of TI was 20.59.52-287-78095326-2018.

Statistical analysis was carried out using descriptive statistics for dynamic variables, which included the calculation of the Median (Me), its statistical error (me), and the first and third quartiles (Q1 and Q3). The statistical significance of the dynamic values of the constancy of the ratios of events was checked by the Yates correction's Log-rank test. The correlation was calculated according to Spearman. The reliability of the correlation coefficient was calculated using the Student's t-test (Glantz, 2012). We used the Microsoft Office Excel 2007 program to intensify the mathematical data processing.

Results

This type of bird was chosen because of its small size and the ability to keep it in the vivarium of the laboratory of the Novosibirsk State Agrarian University. The drug Vetom 1 has not been studied on this type of ornamental bird, there is no mention in the literature of a combined method of using the acaricidal ointment "Aversectin" and the probiotic drug Vetom 1. The scientific hypothesis was the theory of synergistic interaction of these drugs.

Veterinary probiotic Vetom 1 is a symbiotic drug that has a positive effect on the microbiome of the gastrointestinal tract of farm birds.

Budgerigars began to recover faster from diarrheal syndrome under the influence of the probiotic Vetom 1 and during therapy with "Aversectin" ointment from Knemidocoptes (Table 1). The median of the convalescence period of the diarrheal syndrome in the experimental budgerigars came two days earlier than the control ($p<0.01$) relative to the experimental group. The 1st quartile of the convalescence period of the diarrheal syndrome in budgerigars from the experimental group came 3.5 days earlier ($p<0.01$). The 3rd quartile of the

convalescence period in budgerigars in the experimental group came three days earlier ($p<0.01$). The maximum duration of the convalescence period of the diarrheal syndrome in the experimental budgies was three days less ($p<0.01$) than in the control.

Thus, in the experimental budgies, the diarrheal syndrome convalescence occurs earlier and faster than in the control (Fig. 1). Consequently, the probiotic Vetom 1 has a pronounced effect on the diarrheal process's dynamic resolution in budgerigars under conditions of "Aversectin" ointment therapy for Knemidocoptes.

In buderigars, the convalescence period of desquamaive perinasal dermatitis did not change with the use of the probiotic Vetom 1 even with the help of the Aversectin ointment against *Knemidokoptes* (Table 1).

Thus, the probiotic Vetom 1 does not affect the rate of convalescence of desquamative perinasal dermatitis of budgerigars when using 0.05% "Aversectin" ointment (Fig. 2).

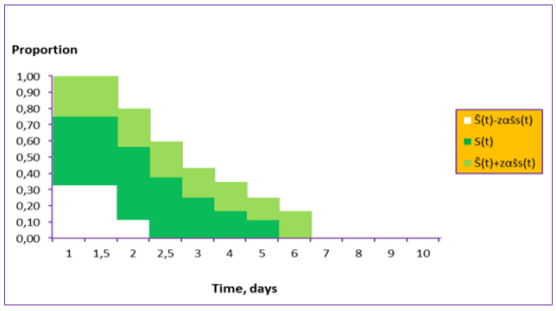
The Spearman correlation coefficients between different fractions of microorganisms in the peri-cloacal area of budgerigars and the dynamics of the disappearance of diarrheal syndrome changed (Table 2). The Enterobacteria titer and the period of the disappearance of the diarrheal syndrome in the control Budgerigars had a significant positive correlation with high tension. In contrast, in the experimental Budgerigars, a negative correlation of these parameters' average stress was recorded (Fig. 2).

The titer of *Lactobacilli* and the disappearance of the diarrheal syndrome in the control Budgerigars positively correlated with weak tension. In contrast, in the experimental Budgerigars, a negative correlation of the mean voltage between these parameters was recorded (Fig. 2). These dependencies indicated a weakly unexpressed effect of *Lactobacilli* on developing the pathological process of diarrhea in budgies. The use of the probiotic Vetom 1 also suppresses this process. The titer of *Lactobacilli* has little effect on the convalescence period and is in the pathogen's wrong direction.

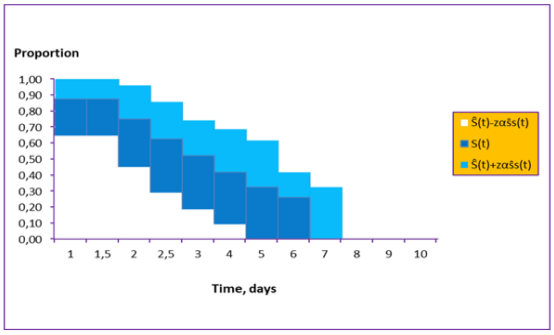
The titer of *Bifidobacteria* and the period of the disappearance of the diarrheal syndrome in Budgerigars of the control and experimental groups had a negative correlation of medium and robust tension, respectively (Fig. 2). These dependencies process of diarrheal in budgerigars. The probiotic Vetom 1 also does not affect the involving *Bifidobacteria* in the pathological process.

The titer of corynebacteria and the period of the disappearance of the diarrheal syndrome in the control Budgerigars had a negative correlation with mean tension. In contrast, in the experimental Budgerigars, a positive correlation of weak voltage between restrictions was these parameters (Fig. 2). These dependencies indicated a weakly expressed unreliable effect of corynebacteria on suppressing diarrhea's pathological process in budgerigars. The probiotic Vetom 1 changes this process.

The Spearman correlation coefficients between different fractions of microorganisms in the peri-cloacal area of budgerigars and the dynamics of the disappearance of desquamative perinasal dermatitis changed (Table 2).



(A)



(B)

Fig. 1: Dynamics of the disappearance of the diarrheal syndrome in budgerigars during "Aversectin" ointment therapy of Knemidocoptes: (A)-In the control group; (B)-In the experimental group

Table 1: Dynamics of elimination of the main symptoms against therapy background with "Aversectin" ointment for Knemidocoptes for budgies, days

Group	Me ± me	Q_1	Q_3	Max
Diarrheal syndrome				
Control	7.50±0.75	6.50	10.50	11.00
Experimental	5.50±0.55**	3.00**	7.50**	8.00**
Desquamative perinasal dermatitis				
Control	2.00±0.20	3.00	6.50	7.00
Experimental	2.00±0.20	3.00	6.50	7.00

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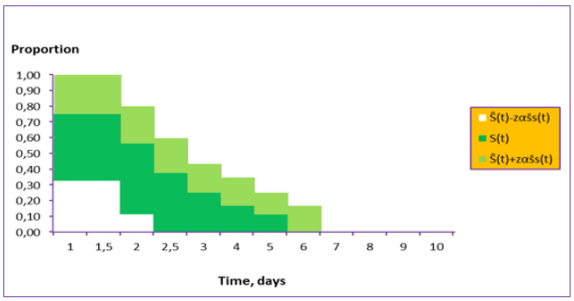
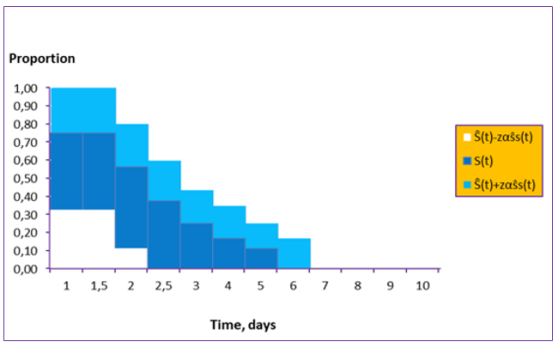
Table 2: Correlation of the support between the period changes in the studied clinical symptoms and titer individual families of microorganisms in the peri-cloacal, R_{xy} spearman

Group	Enterobacteriaceae	*Lactobacilli*	*Bifidbacteria*	*Corynebacteria*
Diarrheal syndrome fixation period, days				
Control	0.73**	0.05	-0.43	-0.46
Experimental	-0.43	-0.32	-0.86	0.26
Period of fixation of desquamate perinatal dermatitis, days				
Control	-0.20	0.25	0.54	0.09
Experimental	-0.02	-0.45	0.15	0.01



(A)



(B)

Fig. 2: Dynamics of the disappearance of desquamative perianal dermatitis in budgerigars during "Aversectin" ointment therapy of Knemidocoptes: (A)-In the control group; (B)-In the experimental group

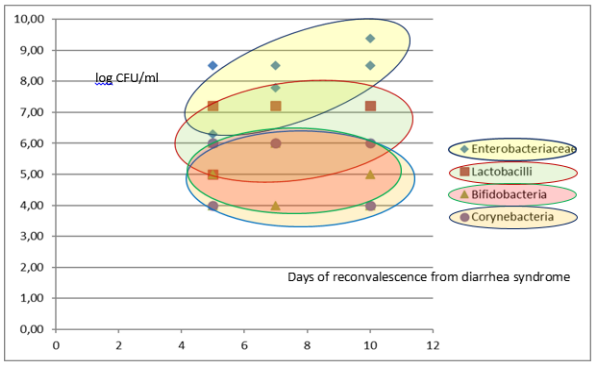


Fig. 3: Dependence of the convalescence of the diarrheal syndrome and the titer of individual families of microorganisms in the control group

The titer of Enterobacteriaceae and the convalescence period of the diarrheal syndrome in Budgerigars of the control and experimental groups negatively correlated with weak tension (Figs. 3-4). These dependencies indicated a weakly expressed effect of enterobacteria on developing the pathological process of desquamative dermatitis in budgerigars (Figs. 5-6). The use of the probiotic Vetom 1 has little impact on this process.

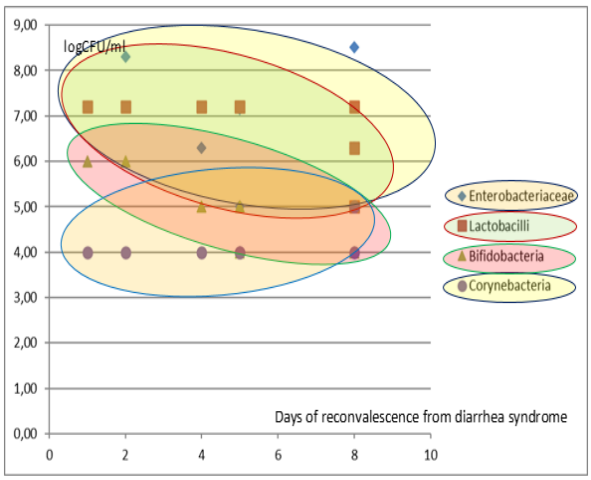


Fig. 4: Dependence of the convalescence of the diarrheal syndrome and the titer of individual families of microorganisms in the experimental group

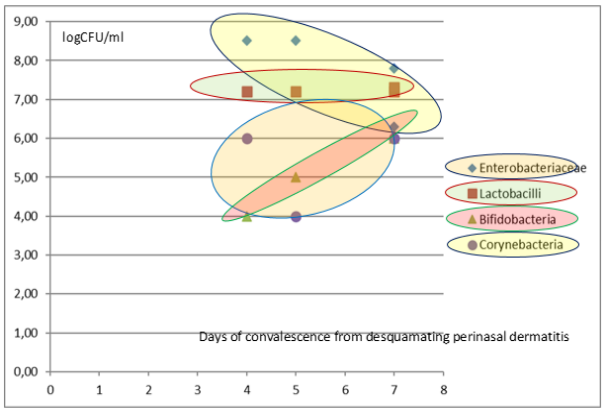


Fig. 5: Dependence of dermatitis convalescence and titer of Individual families of microorganisms in the control

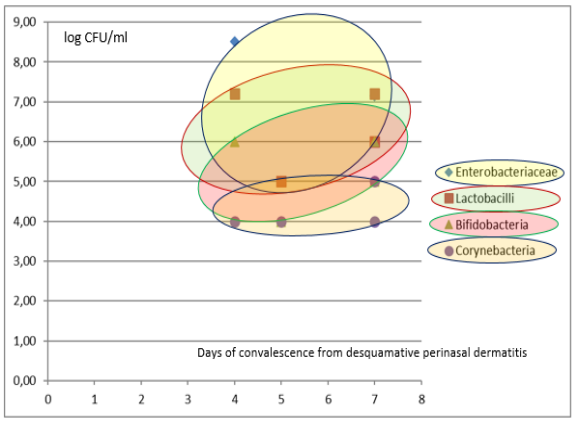


Fig. 6: Support of dermatitis convalescence and titer of particular families of microorganisms in the control group

Discussion

The titer of *Lactobacilli* and the disappearance of the diarrheal syndrome in the control Budgerigars positively correlated with average tension. In contrast, in the experimental group, a negative correlation of moderate stress was recorded. These dependencies indicated a weakly pronounced effect of *Lactobacilli* on the convalescence of the process of desquamative dermatitis in budgies. The healing process is affected by the use of the probiotic Vetom 1. Thus, the probiotic Vetom 1 has a beneficial effect on the microbiological landscape of the intestinal microflora of budgerigars. The results obtained by us confirm the research data on the use of Vetom series preparations by Nozdrin *et al*. (2018; 2020); Elenshleger *et al*. (2019).

The titer of *Bifidobacteria* and the period of the disappearance of the diarrheal syndrome in the control and experimental Budgerigars had a positive correlation of medium and weak intensity, respectively. These dependencies indicate a weakly pronounced effect of *Bifidobacteria* on the convalescence of the process of desquamative dermatitis in budgies. The use of the probiotic preparation Vetom 1 weakly affects this process. Studies by Tretyakova and Necheporuk (2021) confirm the effectiveness of the use of such microbiological preparations in poultry farming.

The authors noted that the titer of *corynebacteria* and the convalescence period of diarrheal syndrome positively correlated with weak tension in the control and experimental groups. This dependence indicates a weakly expressed effect of *corynebacteria* on the convalescence of the budgerigars' desquamative dermatitis process. The use of the probiotic Vetom 1 has little impact on this process.

Conclusion

The probiotic Vetom 1 shortened the period of convalescence with an increase in the duration of the diarrheal syndrome in budgerigars with "Aversectin" therapy for Knemidocoptes. The Vetom 1 does not affect the period and rate of convalescence of desquamative perinasal dermatitis of budgerigars with "Aversectin" therapy for Knemidocoptes. Vetom 1 modulates the micro-biocenosis of the peri-cloacal region, suppressing the harmful effects of enterobacteria in diarrheal syndrome.

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Author's Contributions

All authors equally contributed to this study.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues are involved.

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