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COMPARISON OF THE RECOVERY RATES OF DIFFERENT MORPHOTINCTORIAL GROUPS OF BACTERIA IN PIGSTIES AFTER DISINFECTION WITH 'VOLCANO MAX' AND 'SVITECO PIP MULTI'

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Summary. Disinfection is critical to ensure biological safety in animal breeding and rearing farms. It must be of high quality to prevent the spread of infectious diseases. The effectiveness of disinfection measures is usually assessed by the microbial reduction rate, which characterizes the degree of reduction of microbial contamination. However, the microbiome in pig facilities is quite complex and diverse, as a result of which the recovery of its representatives after disinfection can occur at different rates. Therefore, for a more objective assessment of the quality of disinfection and comparison of the effectiveness of disinfectants, it is necessary to consider not only the initial destruction of microorganisms as a result of disinfection, but also the rate of their recovery. The work aimed to compare the effectiveness of 'Sviteco PIP Multi' and 'Volcano Max' in providing longer protection against the recovery of field isolates of bacteria of different morphotinctorial groups at the facilities for pig housing. During microbiological studies of swabs taken from the floor, walls, plastic partitions between cages, feeders and drinkers of sow, farrowing and piglet rearing facilities 3 h, 6 h, 24 h, 48 h, and 72 h after disinfection and at the end of the relevant production cycles, it was found that when using the classic disinfectant 'Volcano Max' at the first stages of the study, the number of swabs containing microorganisms was absent or minimal. Starting from 72 h after its use, the number of positive swabs from all the studied objects reached 100%, regardless of the type of room. When using the experimental 'Sviteco PIP Multi', within 3 h after treatment, microbial growth was detected in 100% of the swabs taken from the floor, between cage partitions and feeders, 83.3% from the walls and 62.2% from the drinkers. The explanation for this may be that this disinfectant contains spores of the probiotic bacteria *Bacillus subtilis* and *Bacillus megaterium*, which, together with it, get onto the objects to be disinfected, quickly colonize sterile surfaces, get into the swabs and grow on the culture medium. Microscopic analysis of swabs made from cultures that grew from the swabs proved that Gram-positive bacilli were the first to recover after disinfection with 'Volcano Max' and 'Sviteco PIP Multi'. Further, against the background of a decrease in their number, an increase in Gram-negative rod-shaped bacteria and coccal microflora was noted. These changes were less pronounced when using the experimental 'Sviteco PIP Multi', which indicates a short-term inhibition of the development of microorganisms by the traditional 'Volcano Max'. The prolonged disinfectant effect of disinfection of pig housing facilities with 'Sviteco PIP Multi' is due to a change in the composition of the microbial community of surfaces due to their rapid colonization by beneficial bacilli belonging to the morphotyntactic group of Gram-positive bacilli and the creation of competition for other microbes. The results obtained indicate different dynamics of microflora repopulation depending on the agent used and the feasibility of further research to assess the effectiveness of probiotic disinfectants in veterinary practice

Keywords: disinfectants, effectiveness, long protection, microflora

Introduction. Pig breeding in Ukraine is the second, after poultry, branch of agriculture, which plays an important role in ensuring a balanced diet of the population and economic development of the country (Lykhach et al., 2023).

However, the intensive technology of pig breeding in the premises where they are kept creates quite favorable conditions for the development and spread of various microorganisms, including pathogens, which can negatively affect animal health and, as a result, the profitability of the farm (Lyasota et al., 2022; Zhumakayeva et al., 2024).

Disinfecting livestock facilities and objects is essential for biological safety and preventing the spread of infectious diseases among animals (Komisarova et al., 2023; Makovska et al., 2024).

The key factors that determine the effectiveness of disinfection are the assessment of the microbial load, the correct choice of disinfectant and the method of its application (Titova, 2018; Aranke et al., 2021).

The microbiome of pig facilities is complex and diverse (Hong et al., 2021; Shkromada and Hrek, 2022). Therefore, the recovery of bacteria after disinfection can occur at varying rates (Artasensi, Mazzotta and Fumagalli, 2021). Therefore, to objectively determine the quality of disinfection, it is necessary to consider not only the initial destruction of microorganisms, but also the rate of their recovery (Maillard and Centeleghe, 2023).

In addition, the availability of data on the recovery of microflora allows us to establish the duration of the protective effect of the disinfectant and determine the need for repeated treatments, compare the effectiveness of different disinfection methods and means, and establish which one provides longer protection. Such results will contribute to deepening knowledge of the dynamics of microbial populations under the influence of various biocidal agents, which is relevant for the development of veterinary microbiology, and will also be important in the development of modern disinfection strategies and biosafety in pig farms (Saini et al., 2025).

The study **aimed** to compare the effectiveness of 'Sviteco PIP Multi' and 'Volcano Max' in providing longer protection against the recovery of field isolates of bacteria of different morphotinctorial groups at pig facilities.

Materials and methods. The study was conducted in farrowing, piglet rearing and sow housing facilities. The material was swabs taken from the floor, between cage partitions, walls, feeders, and drinkers according to the requirements for sampling for microbiological studies in 3 h, 6 h, 24 h, 48 h, and 72 h after disinfection and at the end of the relevant production cycle (SE 'UkrNDNC', 2018).

Disinfection of the facilities was carried out with products whose main active ingredient is quaternary ammonium compounds. As an experimental disinfectant, we used a domestically produced disinfectant 'Sviteco PIP Multi' (SPE 'Eco-Country' LLC, Ukraine), the peculiarity of which is that it contains bacillary forms of probiotic microorganisms *Bacillus subtilis* and *Bacillus megaterium* in the amount of 5×10^7 CFU/ml using the Probiotic in Progress (PIP) technology. To compare the results obtained, similar studies were conducted using the classic disinfectant 'Volcano Max' (Huvepharma, Bulgaria).

Both disinfectants were applied by irrigation during the treatment of the facilities. 'Sviteco PIP Multi' was sprayed using Sviteco-Probio Nano Professional equipment, and 'Volcano Max' was sprayed using Aqua Master high-pressure apparatus. The concentration of the working solutions was 0.5%, and their consumption per 100 m^2 of area was 0.2 l for 'Sviteco PIP Multi' and 2.5 l for 'Volcano Max'.

Indicators characterizing the dynamics of microflora recovery at the facilities for keeping pigs were the total number of mesophilic aerobic and facultative anaerobic microorganisms (MAFANM) and the proportion of Gram(+)rod-shaped, Gram(−) rod-shaped, and Gram(+) coccal bacteria in this number (Yakubchak et al., 2005).

To determine the total number of MAFANMs from each sample, tenfold serial dilutions were made, and the cultures were inoculated onto meat-peptone agar poured into Petri dishes.

The cultures were incubated in a thermostat for 24 h at a temperature of 37°C, the number of colonies was counted, and the number of colony-forming units per 1 cm^3 of the wash was calculated (Green and Goldman, 2021).

Results. As a result of microbiological studies of swabs taken from the floor of the pig housing facilities 3 h after their disinfection with the classic disinfectant 'Volcano Max' and the experimental disinfectant 'Sviteco PIP Multi' (Table 1), in both cases the growth of microorganisms was established. Thus, during the specified period, when using 'Volcano Max', the growth of microorganisms was noted in three swabs taken in the farrowing room, which was 10% of the total number of samples. After 6 h, the number of samples containing microbial growth increased to 26.7%, and over the next 18 h to 33.3%. In 48 h, the number of swabs containing microorganisms was 73.3%, and from 72 h to the end of the production cycle, microbial growth was present in 100% of the samples.

Table 1 — Time of microflora repopulation on the floor of pig housing after disinfection (n = 30)

Facility	Time, h	Disinfectant			
		'Volcano Max'		'Sviteco PIP Multi'	
		number of swabs	%	number of swabs	%
Farrowing room	3	3	10.0	30	100.0
	6	8	26.7	30	100.0
	24	10	33.3	30	100.0
	48	22	73.3	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0
Piglet growing room	3	4	13.3	30	100.0
	6	11	36.7	30	100.0
	24	12	40.0	30	100.0
	48	25	83.3	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0
Sow housing	3	4	13.3	30	100.0
	6	14	46.7	30	100.0
	24	15	50.0	30	100.0
	48	27	90.0	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0

Notes: EE — end of experiment.

On the floor of the piglet growing rooms, the recovery of microflora after disinfection with 'Volcano Max' was more intense. Thus, the number of swabs with microbial growth was 13.3% after 3 h, 36.7% after 6 h, 40% after 24 h, 83.3% after 48 h, and 100% from 72 h to the end of the experiment.

When using a classical disinfectant, the microflora was similarly restored on the floor of other studied premises. In particular, the number of positive swabs in 3 h after disinfection was 13.3%, 6 h — 46.7%, 24 h — 50%, 48 h — 90%, and 72 h — 100%.

The dynamics of microflora recovery at the investigated facility was somewhat different when using the experimental agent 'Sviteco PIP Multi', the components of which are spores of probiotic microorganisms, namely *Bacillus subtilis* and *Bacillus megaterium*. As can be seen from the results presented in the above Table 1, the growth of microorganisms was observed in 100% of the swabs taken from the floors of all the studied premises starting as early as 3 h after the completion of disinfection measures. The reason for this may be that, along with the disinfectant, spores of probiotic bacilli colonize the disinfected surfaces, which then enter the swab and the nutrient medium where they grow.

To comprehensively assess the effectiveness of disinfection performed by classical and experimental

disinfectants, as well as to identify viable microorganisms, assess their morphological and tinctorial characteristics, and determine possible residual contamination, microscopic analysis of smears made from microbial cultures isolated after disinfection was performed.

The data presented in Fig. 1 shows that in 3 h after the use of 'Volcano Max' and 'Sviteco PIP Multi', Gram-positive and Gram-negative bacilli were isolated, the number of which was 98.4% and 99.7%, and 1.6% and 0.3%, respectively.

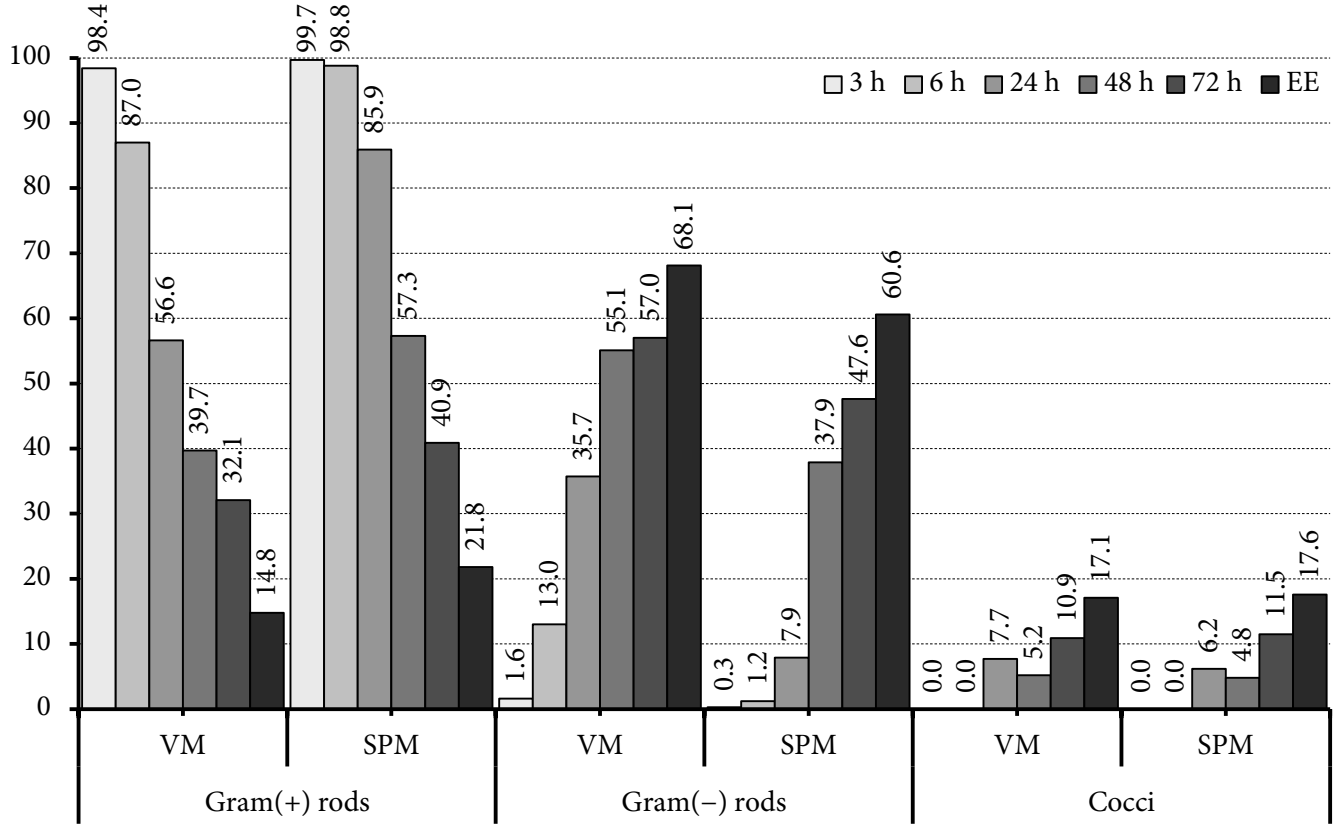

Figure 1. Results of microscopic analysis of swabs obtained from cultures grown from samples taken from the floor after disinfection, %: EE — end of experiment; VM — 'Volcano Max'; SPM — 'Sviteco PIP Multi'.

In 6 h after disinfection, compared to 3 h, an increase of 11.4% of Gram-negative and a decrease of the same number of Gram-positive rod-shaped microorganisms was observed when using 'Volcano Max' and, respectively, 0.9% when using 'Sviteco PIP Multi'.

Starting from 24 h, coccal microflora was first detected at 7.7% and 6.2%, showing a lower count than the experimental disinfectant group. During this period of the study, the number of Gram-negative and Gram-positive bacteria was 35.7% and 7.9%, and 56.6% and 85.9%, respectively.

Compared to 24 h, 48 h after using the classic product, a 19.4% decrease in the number of Gram-positive bacilli and a 16.9% increase in Gram-negative bacilli and 2.5% increase in cocci were found. When using the experimental product 'Sviteco PIP Multi', the changes were somewhat different, as the number of Gram-positive bacilli and cocci decreased by 28.6% and 1.4%, respectively, and Gram-negative bacilli increased by 30%.

At 72 h, the number of Gram-negative rod-shaped microbes became even lower and the difference with the previous experimental period was 7.6% when using 'Volcano Max', and 16.4% when disinfecting with 'Sviteco PIP Multi'. Simultaneously, the number of Gram-negative bacilli and cocci increased by 1.9%, 9.7%, and 5.7%, 6.7%, respectively.

At the end of the experiment, which coincided with the end of the respective production cycle, a significant dominance of Gram-negative rod-shaped microorganisms was found when using both disinfectants, the number of which was 7.5% higher than when using the classic 'Volcano Max'.

Accordingly, the number of Gram-positive bacilli was 7% higher when using 'Sviteco PIP Multi'. The number of cocci was practically the same and amounted to 17.1% and 17.6%, respectively.

The results of the study of swabs taken from the inter-cage partitions of the facilities for keeping pigs with the use of the disinfectants under study are presented in Table 2.

The data in Table 2 shows that 3 h after disinfection with 'Volcano Max' on the plastic partitions between cages in the farrowing and piglet rearing facilities the number of swabs containing microflora was 6.7%, and for sows it was 10%.

Table 2 — Time of microflora repopulation on the inter-cage partitions of pig housing after disinfection (n = 30)

Facility	Time, h	Disinfectant			
		'Volcano Max'		'Sviteco PIP Multi'	
		number of swabs	%	number of swabs	%
Farrowing room	3	2	6.7	30	100.0
	6	4	13.3	30	100.0
	24	10	33.3	30	100.0
	48	20	66.7	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0
Piglet growing room	3	2	6.7	30	100.0
	6	5	16.7	30	100.0
	24	11	36.7	30	100.0
	48	24	80.0	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0
Sow housing	3	3	10.0	30	100.0
	6	7	23.3	30	100.0
	24	13	43.3	30	100.0
	48	26	86.7	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0

Notes: EE — end of experiment.

In 6 h after using a classic disinfectant, the number of swabs with microorganisms in the farrowing room increased to 13.3%, in 24 h — to 33.3%, in 48 h — to 66.7%, and from 72 h to the end of the production cycle — to 100%. In the piglet rearing and sow housing facilities, the number of positive swabs after 6 h was 16.7% and 23.3%, respectively, after 24 h — 36.7% and 43.3%, after 48 h — 80% and 86.7%, and after 72 h — 100%.

When using the experimental disinfectant 'Sviteco PIP Multi' for disinfection, as in the previous case, 100% of the swabs taken from all rooms also contained viable microorganisms, the growth of which was already evident starting from 3 h after the completion of disinfection.

Analyzing the results of microscopic examination of the swabs (Fig. 2), it is clear that, as on the floor, the restored microflora on plastic partitions 3 h after the use of disinfectants was 99% and 99.4% represented by Gram-positive rod-shaped microorganisms.

Starting from 24 h and until the end of the experiment, a gradual decrease in the number of Gram-positive and an increase in Gram-negative bacilli was observed, which was more intense in the case of disinfection with the classic 'Volcano Max'. In particular, compared to 3 h, the number of Gram-positive bacilli decreased by 10.6% after 6 h, by 15.8% after 24 h, by 49.7% after 48 h, by 52.5% after 72 h, and by the end of the experiment by 55.7%.

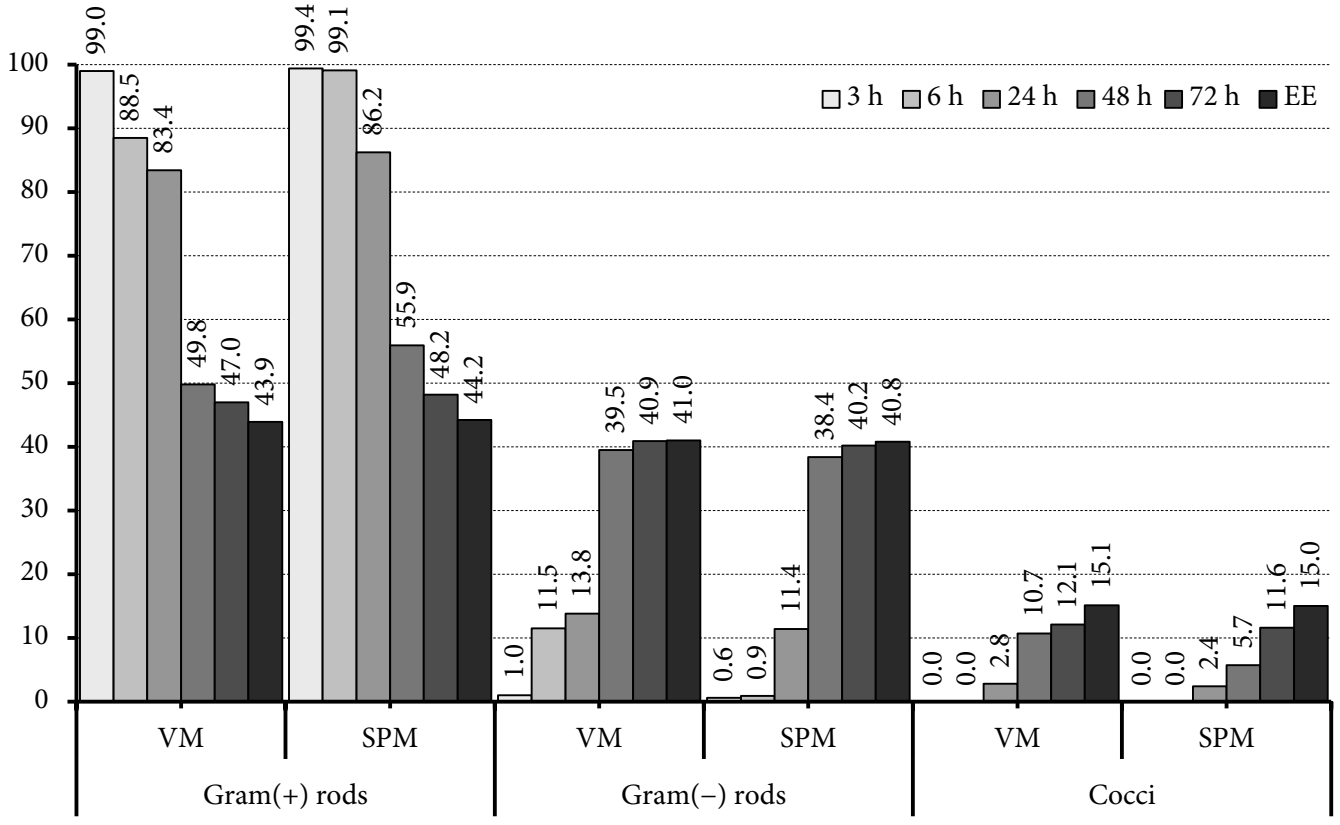

Figure 2. Results of microscopic analysis of swabs obtained from cultures grown from samples taken from the plastic intercellular partitions after disinfection, %: EE — end of experiment; VM — 'Volcano Max'; SPM — 'Sviteco PIP Multi'.

When 'Sviteco PIP Multi' was used, this decrease was 0.3%, 13.2%, 43.5%, 51.2%, and 55.2%, respectively. At the same time, the increase in the number of Gram-negative rod-shaped bacteria in the indicated periods under the influence of 'Volcano Max' was 10.4%, 12.8%, 38.5%, 39.9%, and 40%, and under the influence of 'Sviteco PIP Multi' — 0.3%, 10.8%, 37.7%, 39.6%, and 40.2%, respectively. Spherical microorganisms also prevailed in the swabs taken after disinfection with 'Volcano Max', and the difference compared to the swabs taken after using 'Sviteco PIP Multi' after 24 h was 0.4%, after 48 h — 5%, after 72 h — 0.9% and at the end of the cycle — 0.1%.

The data in Table 3 shows that 3 h after disinfection with 'Volcano Max' on the walls in the farrowing rooms the number of swabs containing microflora was 3.3%, and in the rearing of piglets and the keeping of sows, 6.7% each.

Table 3 — Time of microflora repopulation on the walls of pig housing after disinfection (n = 30)

Facility	Time, h	Disinfectant			
		'Volcano Max'		'Sviteco PIP Multi'	
		number of swabs	%	number of swabs	%
Farrowing room	3	1	3.3	25	83.3
	6	3	10.0	27	90.0
	24	8	26.7	30	100.0
	48	18	60.0	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0
Piglet growing room	3	2	6.7	26	86.7
	6	5	16.7	30	100.0
	24	10	33.3	30	100.0
	48	23	76.7	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0
Sow housing	3	2	6.7	28	93.3
	6	4	13.3	30	100.0
	24	13	43.3	30	100.0
	48	25	83.3	30	100.0
	72	30	100.0	30	100.0
	EE	30	100.0	30	100.0

Notes: EE — end of experiment.

After 6 h, the growth of microflora on the nutrient medium was observed when sowing 10% of the swabs taken from the farrowing rooms, 16.7% — the rooms for growing piglets, and 13.3% — the room for keeping sows. By 24 h, the number of positive swabs from the walls of the farrowing room increased to 26.7%, piglet rearing rooms to 33.3%, and sow housing rooms to 43.3%. The recovery of microflora continued in subsequent periods, which is confirmed by an increase in the number of positive swabs taken in subsequent periods. Thus, their number after 72 h in the farrowing room was 60%, for growing piglets — 76.6% and for keeping sows — 83.3%. In the two subsequent periods determined for the study, the number of positive swabs taken from the walls of the facilities for keeping pigs of all production groups was 100%.

When using the experimental disinfectant 'Sviteco PIP Multi' for disinfection of facilities, the situation with the recovery of microflora on the walls was similar to its recovery on the floor and plastic partitions between cages, but had some peculiarities. In particular, although the recovery of microorganisms on the walls occurred by 3 h after the application of the experimental disinfectant, 100% of positive swabs in the sow housing facility were obtained 6 h later, and in the farrowing room as late as 24 h after the completion of disinfection measures.

Analyzing the data presented in Fig. 3, it was found that the recovery of microbes on the walls was similar to their recovery on the floor and plastic partitions between cages. As in the previous study sites, a decrease in the number of Gram-positive bacilli was observed throughout the entire study period, which was from 3 h after disinfection to the end of the experiment, 62% for the classic and 46.5% for the experimental disinfectants, respectively

In contrast to the floor and plastic inter-cell partitions, the increase in Gram-negative rod-shaped microorganisms after disinfection with 'Volcano Max' lasted up to 72 h, and with 'Sviteco PIP Multi' up to 48 h. It was during these periods that the maximum number of these microorganisms was found, which was 42.5 and 33.3%, respectively.

At the end of the production cycle, their number decreased to 34.5% and 21.5%, and the number of cocci increased to 28.2% when using 'Volcano Max' and to 25.1% when using 'Sviteco PIP Multi'. Such indicators were the highest, because the number of cocci on the floor and plastic partitions during the specified period of the study was in the range of 17.1% to 17.6% and 15% to 15.1%.

Table 4 shows the results of studies of the dynamics of microflora recovery on the feeders.

The analysis of these data revealed that with the use of the disinfectant 'Volcano Max', the recovery of microflora in the premises also occurred within 3 h. It was also determined that the recovery process was slower on the feeders in the farrowing room than in the rooms intended for keeping pigs of other technological groups. This is confirmed by the fact that the number of positive swabs taken in this room after 6 h was 25%, after 24 h — 37.5%, after 48 h — 50%, after 72 h — 87.5%, and only at the final stage reached 100%, while in the other two studied rooms, the number of positive samples after 6 h was 37.5%, after 24 h — 62.5%, after 48 h — 75% and 87.5%, and after 72 h — 100%, respectively.

When 'Sviteco PIP Multi' was used for disinfection, starting from 3 h after the disinfection process, 100% of the samples taken from the feeders of all the studied rooms contained microorganisms.

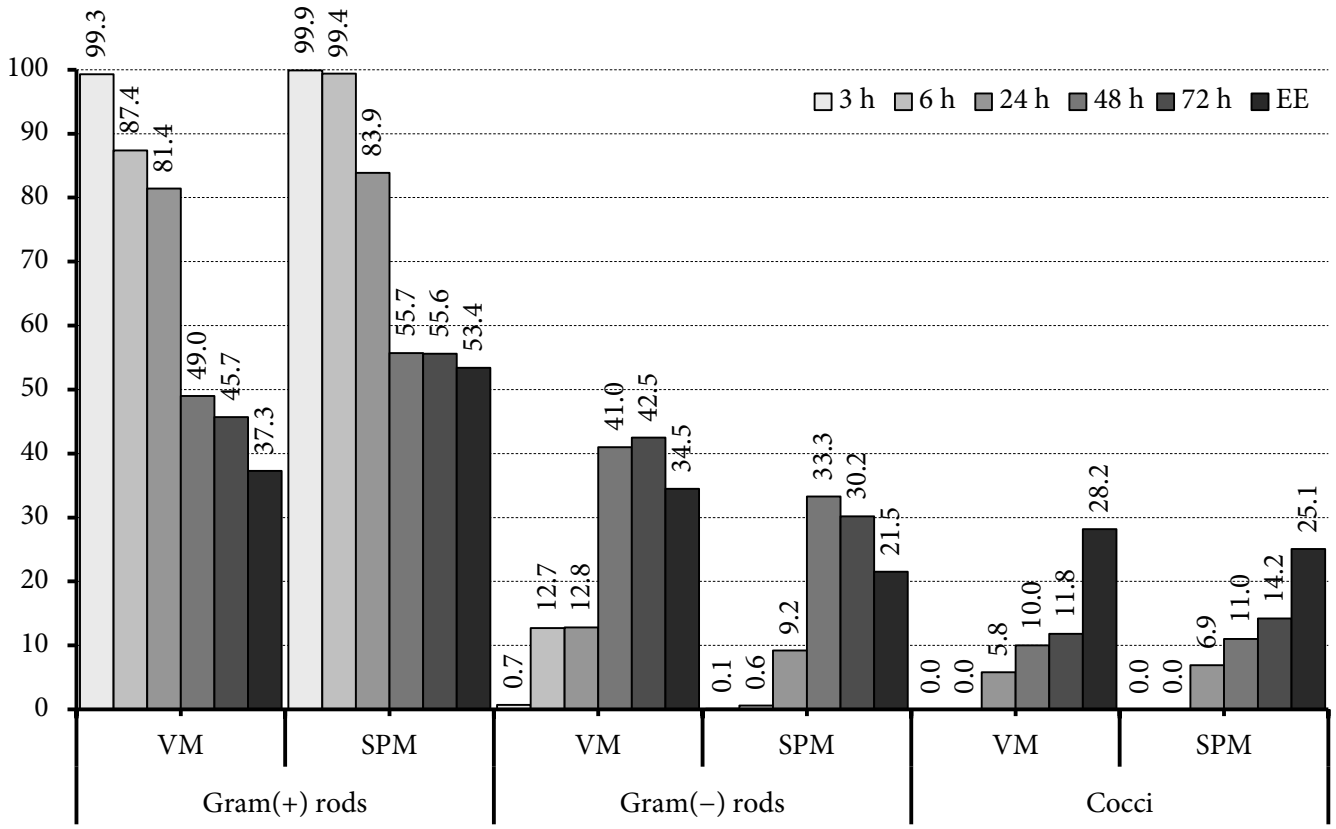

Figure 3. Results of microscopic analysis of swabs obtained from cultures grown from samples taken from walls after disinfection, %: EE — end of experiment; VM — 'Volcano Max'; SPM — 'Sviteco PIP Multi'.

Table 4 — Time of microflora repopulation on feeders in pig housing facilities after disinfection (n = 8)

Facility	Time, h	Disinfectant			
		'Volcano Max'		'Sviteco PIP Multi'	
		number of swabs	%	number of swabs	%
Farrowing room	3	1	12.5	8	100.0
	6	2	25.0	8	100.0
	24	3	37.5	8	100.0
	48	4	50.0	8	100.0
	72	7	87.5	8	100.0
	EE	8	100.0	8	100.0
Piglet growing room	3	2	25.0	8	100.0
	6	3	37.5	8	100.0
	24	5	62.5	8	100.0
	48	6	75.0	8	100.0
	72	8	100.0	8	100.0
	EE	8	100.0	8	100.0
Sow housing	3	1	12.5	8	100.0
	6	3	37.5	8	100.0
	24	5	62.5	8	100.0
	48	7	87.5	8	100.0
	72	8	100.0	8	100.0
	EE	8	100.0	8	100.0

Notes: EE — end of experiment.

From the data shown in Fig. 4, it can be observed that in 3 h and 6 h after disinfection with 'Volcano Max' in the swabs taken from the feeders, the isolated microorganisms, as in the previous studied facilities, were represented by Gram-positive and Gram-negative rod-shaped bacteria, the number of which was 98.9%, 1.1% and 86.8%, 13.2%, respectively.

After 24 h, the content of Gram-positive bacilli in the selected flushes decreased by 18.4% compared to 3 h, Gram-negative bacilli increased by 15.5%, and the recovery of coccal microorganisms was found, the number of which was 2.9%.

At 48 h, 72 h, and at the end of the experiment, the percentage of Gram-positive bacilli found in the selected swabs was 49.8%, 48.3%, and 47%, respectively. These levels exceeded the number of Gram-negative bacilli by 8.8%, 7.2%, and 6.1%, and cocci by 9.2%, 10.6%, and 12.1% respectively.

When using 'Sviteco PIP Multi', the dominance of Gram-positive rod-shaped microorganisms was established already after 3 h, where their number was 99.9%. After the next 3 h, their number on the feeders decreased by only 0.2%, however, it was 0.8% higher than when using a classic disinfectant during this period. By the end of the experiment, the number of Gram-positive bacilli decreased, but compared to the use of 'Volcano Max', their number was 6.6% higher after 24 h, 11% after 48 h, 12.1% after 72 h, and 11.4% at the end of the experiment.

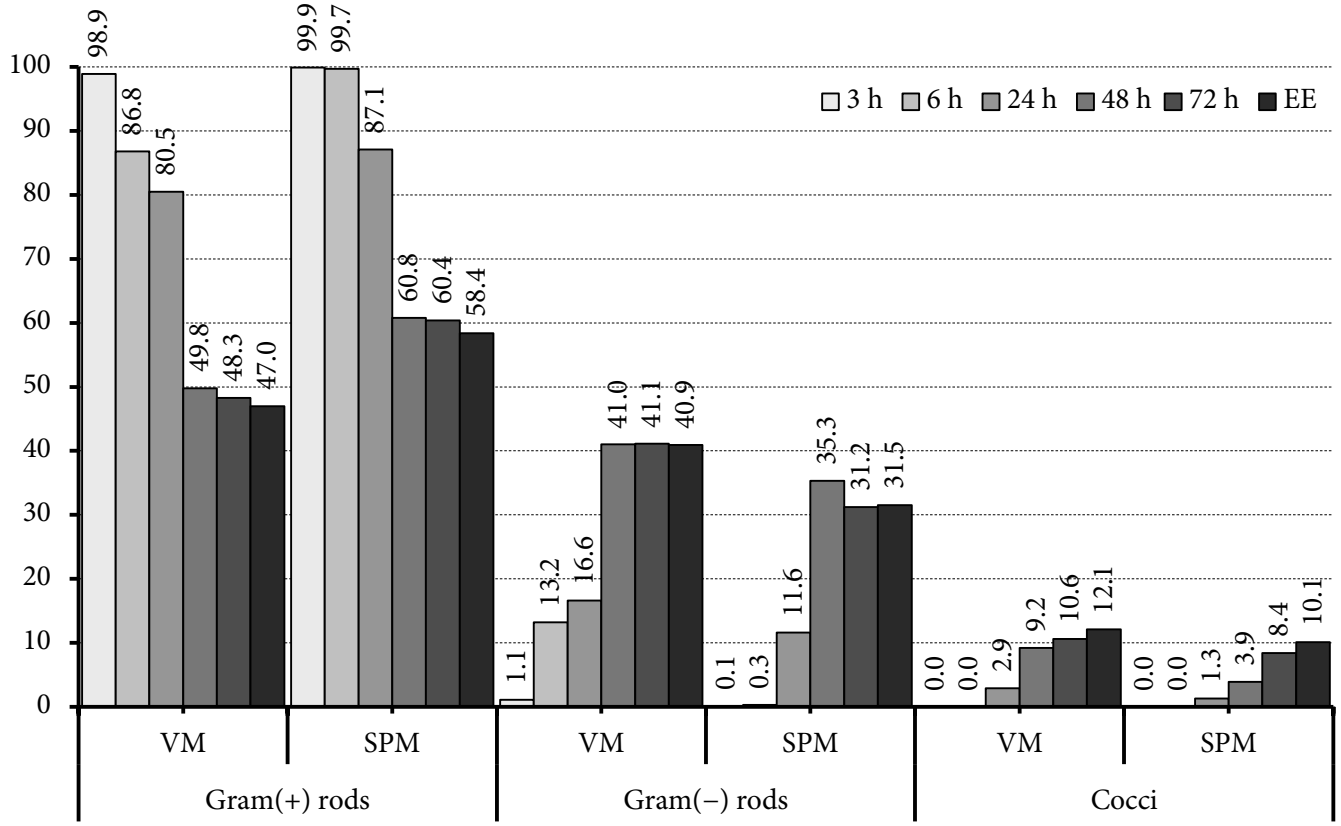

Figure 4. Results of microscopic analysis of swabs obtained from cultures grown from samples taken from feeders after disinfection, %: EE — end of experiment; VM — 'Volcano Max'; SPM — 'Sviteco PIP Multi'.

The number of Gram-negative bacilli on the feeders in all the defined periods of the study was higher when using the disinfectant 'Volcano Max'. In particular, in 3 h after disinfection, the difference was 1% in 6 h — 12.9%, in 24 h — 5%, in 48 h — 5.7%, in 72 h — 9.9%, and at the end of the experiment — 9.4%.

The recovery of coccal microorganisms using both the classical and experimental disinfectant occurred no earlier than 6 h after the completion of disinfection measures, and their number was also lower than after disinfection with 'Sviteco PIP Multi'. At the same time, the established difference at 24 h was 1.6%, at 48 h — 5.3%, at 72 h — 2.2% and at the end of production cycles — 2%.

The rate of recovery of microorganisms of different morphotinctorial groups on the drinking bowls of pigsties is also worthy of attention.

The data presented in Table 5 show that after 3 h the use of the disinfectant 'Volcano Max' the number of positive swabs from the farrowing room was 12.5%, the piglet rearing room — 37%, and the sow housing — 25%. Over the next 3 h the number of swabs containing microorganisms increased to 25% from the farrowing room and to 50% from the piglet rearing and sow housing. After 48 h, the number of positive swabs from all rooms was 87.5%. Starting from 72 h and until the end of production cycles, the number of positive swabs from drinking bowls in the pig housing facilities of all production groups was 100%.

Table 5 — Time of microflora repopulation on drinking bowls in pig housing facilities after disinfection (n = 8)

Facility	Time, h	Disinfectant			
		'Volcano Max'		'Sviteco PIP Multi'	
		number of swabs	%	number of swabs	%
Farrowing room	3	1	12.5	5	62.5
	6	2	25.0	7	87.5
	24	5	62.5	8	100.0
	48	7	87.5	8	100.0
	72	8	100.0	8	100.0
	EE	8	100.0	8	100.0
Piglet growing room	3	3	37.5	7	87.5
	6	4	50.0	8	100.0
	24	6	75.0	8	100.0
	48	7	87.5	8	100.0
	72	8	100.0	8	100.0
	EE	8	100.0	8	100.0
Sow housing	3	2	25.0	6	75.0
	6	4	50.0	8	100.0
	24	6	75.0	8	100.0
	48	7	87.5	8	100.0
	72	8	100.0	8	100.0
	EE	8	100.0	8	100.0

Notes: EE — end of experiment.

When 'Sviteco PIP Multi' was used for disinfection of facilities, positive swabs from drinking bowls were collected after 3 h. Their number in the farrowing room was 62.5%, in piglet rearing — 87.5% and in sow housing rooms — 87.5%. By 6 h, an increase in their number was noted, which was 25% in the farrowing room, and 12.5% in the rooms for piglets and sows. As a result, 100% of positive swabs from the drinking bowls of the piglet rearing and sow housing facilities were obtained already 6 h after disinfection, and from the farrowing room — after 24 h.

From the data shown in Fig. 5, it can be observed that at this site, rod-shaped Gram-positive microbes were the first to recover, the number of which at 3 h and 6 h after the application of the experimental agent 'Sviteco PIP Multi' was 100% and 'Volcano Max' — 96.5% and 88.5%, respectively. In 24 h after disinfection with 'Volcano Max', their number in the swabs taken from the drinkers was 79.4%, and when using 'Sviteco PIP Multi' it decreased to 98.1%. At 48 h, the number of these microorganisms decreased to 66.1% and 90.9%, respectively, after 72 h — to 55.3% and 80%, and at the end of the experiment it was 55.3% and 63.4%.

When using the experimental product, a slower recovery of Gram-negative bacilli and cocci was also noted on the drinkers. Thus, at 24 h the difference in the number of Gram-negative bacilli in the swabs taken after the use of 'Volcano Max' and 'Sviteco PIP Multi' was 1.6%, at 48 h — 2.1%, at 72 h — 24%, and at the end of the experiment — 6.6%, and cocci at 72 h — 2.7% and at the end of the experiment — 1.5%.

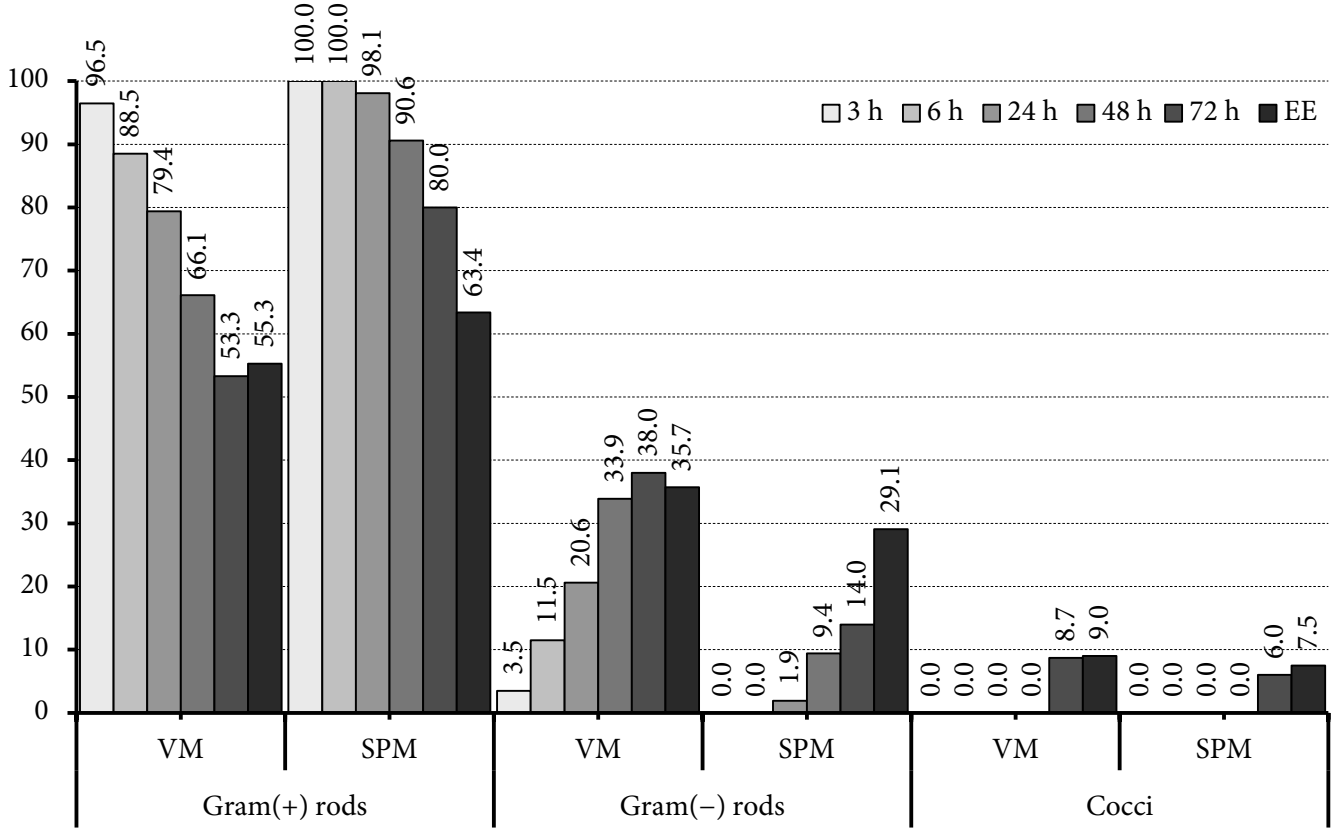

Figure 5. Results of microscopic analysis of swabs obtained from cultures grown from swabs taken from drinkers after disinfection, %: EE — end of experiment; VM — 'Volcano Max'; SPM — 'Sviteco PIP Multi'.

Conclusions. After disinfecting pig housing, researchers observed that the recovery of microflora occurred at different rates depending on the disinfectant used. Notably, when the classic disinfectant 'Volcano Max' was applied, there was a minimal number of positive swabs in the early stages of the study. Regardless of the type of facility, almost all tested environments reached 100% positive surface swabs after 72 h.

In contrast, when the experimental agent 'Sviteco PIP Multi' was used, microorganism growth was detected in 100% of swabs taken from the floor, between cage partitions, and feeders just 3 h post-treatment. From the walls and drinkers, the positive swab rate during this period was 83.3% and 62.2%, respectively. This rapid colonization can be attributed to the presence of spores from probiotic bacteria, specifically *Bacillus subtilis* and *Bacillus megaterium*. These spores, together with the disinfectant, quickly settle on the sterilized surfaces, appear in the swabs, and exhibit growth on the nutrient medium.

Microscopic analysis of the swabs revealed that Gram-positive bacilli were the first to recover after the application of both disinfectants. As their numbers decreased, an increase in Gram-negative bacteria and coccal microflora was noted. This rise was less pronounced when using the experimental 'Sviteco PIP

Multi', which contains spores of Gram-positive, rod-shaped probiotic bacilli.

The results indicate that the traditional disinfectant provides a shorter-term inhibition of microorganisms. In contrast, the experimental agent facilitates rapid colonization of disinfected surfaces with beneficial bacteria, alters the microflora composition, and creates competition for other microbes, thereby prolonging the disinfectant's effectiveness.

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