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Distribution and Etiology of Mastitis in Cows, Economic Damage

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Abstract

It has been established that mastitis is widespread in cow herds in the Krasnodar region. In 2014-2020, from 4.7 to 15.9% of cows were ill with mastitis. It has been established that the main etiological factor in the development of clinical mastitis is pathogenic and opportunistic microflora. Most often, microflora from the udder secretion is isolated in monoculture 52.6%, in association microflora is isolated in 39.7%. The most frequently isolated monocultures include staphylococci, including *S. aureus* (13.1%), *E. agglomerans* (13.1%), α and β hemolytic *streptococci* (13.2%), and *E. coli* (9.8%). Associations occur in the form of 2, 3, and 4 cultures of microorganisms.

Key words: cows, mastitis, distribution, etiology.

One of the important tasks of livestock farming is to increase the production of milk.A serious problem that reduces milk production is mastitis in cows (Abeer A.M., Zakia A.M. *et al* (2016), KarpenkoYu.A.,Griga E.N., *et al* (2014))

The main role in the occurrence of mastitis is assigned to nonspecific or pathogenic microflora (*Staphylococci, Streptococci, Escherichia*), which causes the disease or is layered on the pathological process caused by other factors Malinowski E., Lassa H. *et al* (2006), Bozhenov S.E. (2013). The presence of permanent inhabitants of the gastrointestinal tract in the affected udder quarters of animals: *Enterococcus faecalis*, *Escherichia coli, Fusobacterium necrophorum* indicates unsatisfactory conditions of feeding, keeping animals, non-compliance with veterinary and sanitary rules (insufficient control over the sanitary condition of milking installations, preparation of the udder for milking, the milking process.) Artem'eva O.A., Pereselkova D.A. *et al* (2015), V.A. Dolganov, O.S. Epanchintseva *et al* (2012)

The development of a pathological process in the animal's mammary gland is a secondary and largely compensatory factor. Various factors can complicate the clinical presentation of mastitis in cows and increase the risk of disease recurrence. Violation of technological rules milking, microclimate parameters, penetration infectious agent from outside or activation by pathogenic microflora on the background of immunodeficiency (Sankar P. – 2016; Kuzmich R.G., Garbuzov A.A *et al* - 2011).

This work aimed to analyze the distribution and etiology of mastitis in cows on farms in the Krasnodar region.

Materials and Methods

The reporting data from the Department of Veterinary Medicine of the Krasnodar Territory and farms of the Krasnodar Territory is used in this work. Microbiological and mycological studies were carried out in the Department of Therapy and Obstetrics of the Krasnodar Scien-

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tific-Research Veterinary Institution, a separate structural unit of the Federal State Budgetary Institution Krasnodar Scientific Center for Animal Science and Veterinary Medicine. The good diffusion method in agarose gel determined the sensitivity of isolated microorganisms to antibiotics. Mathematical and biometric processing of the obtained data was carried out using Windows 2010, and Microsoft Office 2010, and the degree of reliability "P" was established according to the student distribution.

Results and Discussion

According to the Department of Veterinary Medicine of the Krasnodar region, in farms of the Krasnodar region of various forms of ownership, the number of cows from 2014 to 2020 decreased by 11 thousand heads or 8.5%. So in 2014, the livestock was 128,740 heads, and in 2020 it was 116,758 heads. At the same time, the incidence of mastitis in cows did not depend in any way on the number of cows in the herds. Thus, the lowest incidence of mastitis was observed in 2014 and amounted to 4.7% of the cow population (Fig. 1, 2). In 2015, the incidence of mastitis in cows increased 2.8 times and amounted to 13.5%. In 2016, there was an increase in the number of heads by 634, but at the same time, there was a decrease in mastitis in cows by 2.5% or 11.0% compared to the 2016 population. In 2017, the percentage of incidence of mastitis in cows decreased by 1% and amounted to 10.0% with a decrease in the number of animals by 598 heads. In 2018, there was a sharp increase in the incidence of mastitis in cows to 15.9%, with a sharp decrease in the number of animals by 3,537 heads or 2.8%. In 2019 and 2020, a decrease in the incidence of mastitis was recorded by 3.5% and 6%, respectively, of the annual population.

According to the same reports, repeated cases of mastitis were often recorded in cows. In 2015, 2957 cows, or 17.6% were ill again.

In 2016, the lowest percentage of recurrent cow mastitis was recorded over 6 years (Fig. 3). The highest percentage of repeated cases of mastitis in cows was registered in 2020. The number of recurrent cases of cows increased by 6.6% compared to 2019 and by 10.5% compared to 2016.

From 2018 to 2020, in the Department of Therapy and Obstetrics of the Krasnodar Scientific-Research Veterinary Institution, we conducted bacteriological and mycological studies of the secretion of the udder of cows with mastitis. As a result, it was found that out of 116 studied samples from different farms in the Krasnodar region, monocultures were isolated in 52.6% of the studied samples. Associations were recorded in 39.7% of cows with mastitis, while in 3.2% of cows in the udder secretion with clinical mastitis, no microflora was isolated (Fig. 4).

Staphylococci were most frequently isolated from monocultures, including *S. aureus* (13.1%), *E. agglomerans* (13.1%), α and β hemolytic streptococci (13.2%), and E. coli (9.8%) (Fig. 5).

The associations included 2, 3, and 4 cultures of microorganisms, including fungi (Fig. 6). Associations were most often isolated from two cultures of microorganisms (50% of the samples studied): *E. coli* + *S. aureus, E.*

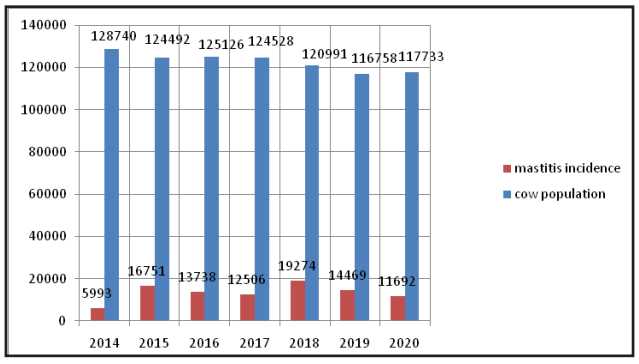

Fig 1. Dynamics of the number of cows and the mastitis incidence in the Krasnodar region 2014-2020.

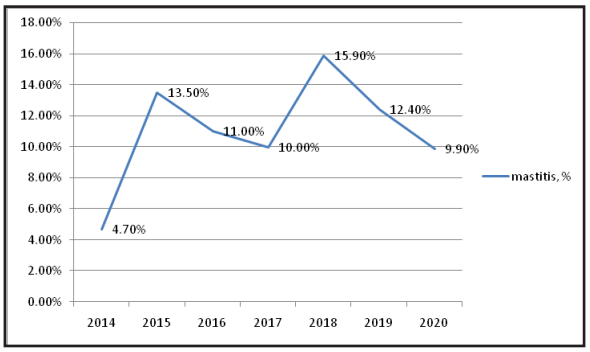

Fig 2. Percentage of mastitis incidence per cow population

Table I. Determination of the sensitivity of microorganisms identified from cows with mastitis to widely used antibiotics and antibacterial drugs intended for the treatment of mastitis in cows (n=4; M±m)

Item №	Antibacterial drug	Identified microflora		
		S. agalactiae	***E.coli***	***S. aureus***
	Gentamicin	11,2±2,60	22,25±1,65	20,75±1,89
	Clindamycin	0±0	0±0	5±5
	Colistin	8,75±5,15	17,5±0,5	13±2,16
	Levomycetin	0±0	11,25±4,27	15,25±5,59
	Metronidazole	5±5	1,75±1,75	0±0
	Nitrofurantoin	0±0	13,25±3,15	3,25±3,25
	Ofloxacin	2,75±2,75	15,5±5,5	12,25±4,09
	Penicillin	3,75±3,75	1,75±1,75	8,75±3,54
	Pefloxacin	3,75±3,75	15,25±5,60	18,5±2,72
	Polymyxin	0±0	11,75±3,95	9,25±3,50
	Sulfetrisan	5±5	0±0	0±0
	Trimethoprim	11,25±6,58	9,33±4,70	5,75±5,75
	Cephalexin	15,5±5,19	6,75±4,15	17,25±5,79
	Ceftiofur	18,75±7,18	12,75±4,75	24,25±2,29
	Enrofloxacin	11,25±7,18	21,25±7,74	9,5±5,5
	Bayoclox DC	0±0	0±0	11±6,67
	Vaccamast	0±0	11,67±6,39	15,5±5,72
	Mamifortsecado	0±0	6,67±6,67	14,5±5,27
	Mastiitisforte	0±0	20,33±3,28	
	Mastizim	0±0	0±0	3,75±3,75
	Norfloxamast	0±0	**20±11,55**	19,5±7,38
	Primalact	5±5	**21,33±2,73**	16,5±5,61
	C-mast	0±0	15±0	16,5±6,06

coli + *S. xylosus, S. agalactiae* + *S. aureus, S. aureus*+ *K. cryocrescens, S. aureus*+*P. mirabilis*. Associations of 3 and 4 cultures were recorded in approximately equal proportions: 26 and 24%, respectively.

The most frequently recorded associations are S. aureus +*K. cryocrescens* + *E. agglomerans; S. aureus* + *P. mirabilis*+ *S. sciuri; S. aureus* + *P. mirabilis*+ *S. sciuri* + *K. cryocrescens; S. aureus* + *K. cryocrescens* + *E. agglomerans; S. aureus* +*S. agalactiae*+ *E. agglomerans.*

One of the main criteria for assessing the

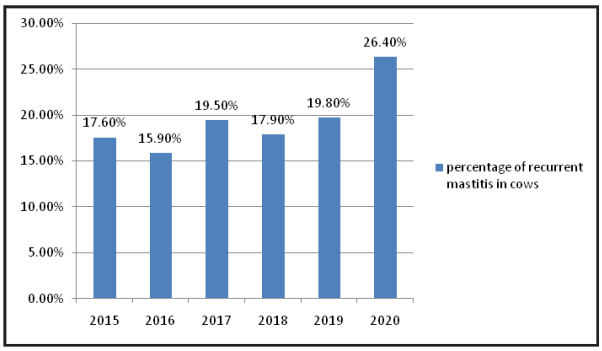

Fig 3. Monitoring the recurrence of mastitis in cows

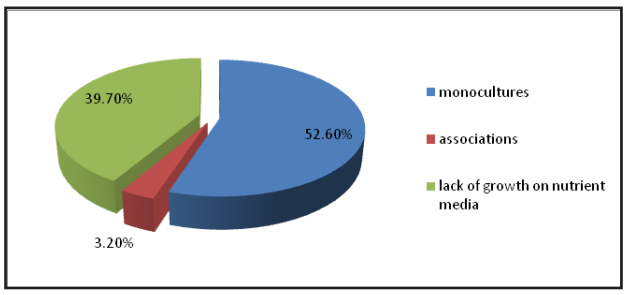

Fig 4. Microbial background of the udder of cows with mastitis

work of the veterinary service is the therapeutic effectiveness of mastitis therapy in cows. According to the Department of Veterinary Medicine reports of the Krasnodar region, it averaged 81% over 6 years. At the same time, the highest efficiency was recorded in 2014 and amounted to 88%, and the lowest - in 2018 - 75%. From 2015 to 2017 inclusive, the therapeutic effectiveness of measures for the treatment of mastitis in cows was 86%.

Most often, on farms in the Krasnodar region, drugs based on broad-spectrum antibiotics are used as a means of treating clinical mastitis in cows, such as Mastiet Forte (tetracycline, neomycin, bacitracin, prednisolone), Primalact (cefotaxime sodium, neomycin sulfate, prednisolone), Vaccamast (dioxin, lincomycin hydrochloride, prednisolone), Ankopen P (benzylpenicillin, kanamycin, prednisolone), Maxifo LC (neomycin, novobiocin, procaine penicillin, dihydrostreptomycin, prednisolone), Mastidian Forte (colistin, cloxacillin, ampicillin, brogexin, chymotrypsin, dexamethosone) etc. These drugs contain several antibiotics and contribute to the development of resistance to antibacterial drugs in microorganisms that cause mastitis [5, 4, 6,10]. To confirm this article, we examined the sensitivity of the most frequently identified microorganisms during mastitis to antibiotics and the most commonly usedanti-mastitis drugs on farms in the Krasnodar region (Table I). As a result of the data obtained, we established that forthe majority of antibiotics used in field crop strains of *S. agalactiae, E. coli, and S. aureus* isolated on different farms, there is no sensitivity in all strains or 50% of the isolated crops. At the same time, the identified *E. coli* strains were sensitive to gentamicin, enrofloxacin, and the drugs Mastiet Forte, Norfloxamast, and Primalact. *S. aureus* was sensitive to gentamicin and ceftiofur, and *S. agalactiae* was not significantly sensitive to any of the drugs tested.

Prednisolone and dexamethasone in the treatment of mastitis are used as an anti-inflammatory agent that inhibits all phases of inflammation, suppress the functions of leukocytes and tissue macrophages, limit the migration of leukocytes to the site of inflammation, reduce the concentration of proteolytic enzymes in the site of inflammation, and reduces capillary permeability. However, the instructions for the use of these preparationcontain a significant number of side effects, including abortions in cows in the last third of pregnancy, and a temporary decrease in milk production in cows.

Also, in the treatment of mastitis, drugs based on antiseptics are widely used, such as Septogel (povidone-iodine), Henoxidine (henoxidine), etc. Among the active ingredients of antimastitis drugs, drugs based on chlorhexidine, hydrogen peroxide, and iodine-containing drugs are more often used. These therapies have both advantages and disadvantages. Thus, antiseptic agents have an immediate bactericidal effect, do not contribute to the development of resistance in microorganisms, but have a narrower spectrum of action on microflora. At the same time, iodine-based preparations can contribute to the drying of the udder mucosa, which can lead to a decrease in milk production.

Based on the above, it is now increasingly important to search for means to treat

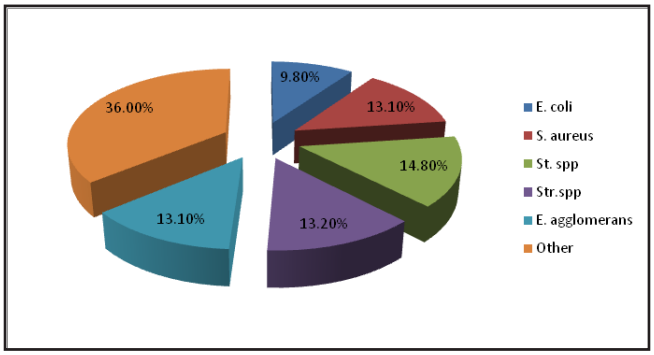

Fig 5. The most frequently identified monocultures of microorganisms during mastitis

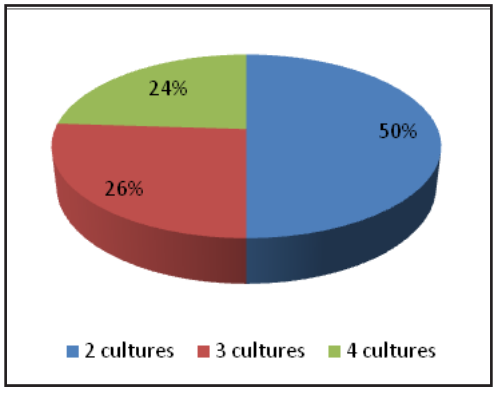

Fig 6. Number of microorganism cultures in association with mastitis in cows

mastitis without the use of chemotherapeutic and antibacterial drugs.

Conclusion

Mastitis is widespread in cow herds in the Krasnodar region. In 2014-2020, from 4.7 to 15.9% of cows suffered from mastitis. At the same time, repeated disease of cows was recorded in 15.9 -26.4% of cases. It has been established that the main etiological factor in the development of clinical mastitis is pathogenic and opportunistic microflora. Most often, microflora from the udder secretion is isolated in monoculture 52.6%, in association microflora is isolated in 39.7%. The most frequently identified monocultures include staphylococci, including S. aureus (13.1%), E. agglomerans (13.1%), α and ß hemolytic streptococci (13.2%), and *E. coli* (9.8%). Associations occur in the form of 2, 3, and 4 cultures of microorganisms. When studying the sensitivity of the most frequently registered microorganisms in mastitis, it was found that to the majority of antibiotics used in strains of field crops S. agalactiae, E. coli, and S. aureus isolated on different farms, either all strains or 50% of isolated cultures lack sensitivity. At the same time, the isolated E. coli strains were sensitive to gentamicin, enrofloxacin, and the drugs Mastiet Forte, Norfloxamast, and Primalact. S. aureus was sensitive to gentamicin and ceftiofur, and S. agalactiae was not significantly sensitive to any of the drugs tested.

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