

БИОТЕХНОЛОГИИ И ХИМИЧЕСКИЕ ТЕХНОЛОГИИ

IRSTI 61.71.31, 62.13.99

https://doi.org/10.53939/1560-5655_2026_1_6

Abylai M.¹, Sansyzbay A.², Yessimsiitova Z.¹

¹Al-Farabi Kazakh National University, Almaty c., Kazakhstan

²Kazakh National Agrarian University, Almaty c., Kazakhstan

DEVELOPMENT OF AN ANTIPARASITIC SHAMPOO FOR PETS TO PROVIDE EFFECTIVE PROTECTION AGAINST EXTERNAL PARASITES

Abstract. An article presents a comprehensive process for developing a natural veterinary shampoo for cats, designed for the prevention and control of external parasites. The formulation is based on safe and effective plant-derived components, such as lavender and eucalyptus essential oils, chamomile infusion, natural liquid soap, and apple cider vinegar. These ingredients possess pronounced anti-septic, anti-inflammatory, and antiparasitic properties, ensuring a gentle yet effective action on the animals' skin and coat. During the creation of the formula, special attention was paid to the physiological characteristics of cats, which allowed for an optimal balance between therapeutic efficacy and application safety. The development process utilized modern laboratory methods for quality and efficacy assessment, and practical tests were conducted in veterinary settings. The results confirmed the shampoo's high effectiveness in eliminating external parasites, improving the condition of the pets' skin and coat, and the absence of side effects or irritation. The data obtained indicate the potential of using this product both for preventive measures and in the treatment of parasitic diseases in domestic cats, especially in conditions of increased risk of infestation. The developed shampoo can become a reliable component of comprehensive animal care in veterinary practice, contributing to the strengthening of their health and the enhancement of their quality of life.

Keywords: antiparasitic shampoo, parasites, fleas, nectars, safe means, essential oils, phytotherapy, chamomile, apple cider drink.

Introduction. Ectoparasite control and prevention in companion animals remain a priority in modern veterinary medicine. These arthropod and insect parasites, particularly fleas, ticks, and lice, are not only a source of significant discomfort for animals but also pose a high risk of causing a range of pathologies. Ectoparasites, such as fleas (*Ctenocephalides* spp.), ticks (*Ixodes* spp., *Otodectes cynotis*), and lice, can lead

to severe discomfort, allergic dermatoses, inflammatory responses, and secondary bacterial infections. Furthermore, they act as vectors for serious diseases including piroplasmiasis, borreliosis, and hemobartonellosis. In severe cases, these infestations can result in anemia, emaciation, and immunodeficiency, which are especially dangerous for kittens and elderly animals. Ectoparasites also represent a significant zoonotic risk, as they can transmit pathogens – such as those causing rickettsiosis and borreliosis – that are dangerous to humans, underscoring their importance in the context of public health [1-7]. Today's market offers a wide array of antiparasitic products, including spot-on treatments, tablets, collars, sprays, and shampoos. However, many of these products contain synthetic insecticides with a limited duration of action. They also have a tendency to cause side effects, such as skin irritation, allergic reactions, and systemic toxicity. Cats, in particular, are especially sensitive to these products due to their unique metabolism [8-12]. This makes the search for alternative, safer antiparasitic options especially relevant.

Today's market offers a wide array of antiparasitic products, including spot-on treatments, tablets, collars, sprays, and shampoos. However, many of these products contain synthetic insecticides with a limited duration of action. They also have a tendency to cause side effects, such as skin irritation, allergic reactions, and systemic toxicity. Cats, in particular, are especially sensitive to these products due to their unique metabolism. This makes the search for alternative, safer antiparasitic options especially relevant. Antiparasitic shampoos are a promising option for topical parasite control, as they offer both the mechanical removal of parasites and the direct application of active ingredients. They can effectively combine skin and coat care with an antiparasitic effect. However, most commercial formulas are too harsh for long-term use and lack sufficient evidence of their effectiveness and tolerability. This is where natural formulas based on essential oils and plant extracts become a key alternative, as they can provide high efficacy, safety, and a conditioning effect. Research has shown that lavender essential oil has insecticidal, repellent, and soothing properties, and is proven to be effective against fleas, while also helping to restore the skin barrier. Eucalyptus exhibits strong acaricidal and antiseptic activity, reducing itching and inflammation caused by ticks and fleas. Chamomile extract provides antiseptic, anti-inflammatory, and regenerative effects, speeding up skin healing. Apple cider vinegar helps break down the chitinous exoskeleton of parasites, normalizes skin pH, and has an antibacterial effect. Natural, plant-based soap provides gentle cleansing without aggressively stripping the skin's lipid layer. These ingredients have been widely studied and have proven their effectiveness in both veterinary and human research [13-19]. Particular interest lies in the domestic scientific base, where researchers from the South Kazakhstan

University and the Kazakh-Turkish University (Turkistan) have demonstrated the effective antimicrobial properties of chamomile and thyme extracts used in veterinary medicine [20]. Furthermore, studies at the University of Veterinary Sanitation in Almaty, led by A. N. Rametov, have confirmed the safety and efficacy of herbal antiseptics in the treatment of dermatological conditions in animals [21]. This underscores the potential and validity of developing a domestic, plant-based shampoo.

Thus, the development of a safe and demonstrably effective natural antiparasitic shampoo is a relevant task that unites veterinary science and societal needs. Such a product can improve the quality of life for companion animals, reduce the incidence of parasitic diseases, and lower zoonotic risks for humans.

The aim of the study was to evaluate the efficacy and safety of a natural antiparasitic shampoo when treating domestic cats infested with ectoparasites.

Materials and methods of Research. In the study, 15 domestic cats aged 1 to 8 years, suffering from infestations with external ectoparasites such as fleas, lice, and ticks, participated. Before the start of the experiment, all animals underwent a clinical examination and were admitted to the study after obtaining informed consent from their owners. The participants were divided into three equal groups of 5 cats each: Group A (experimental), which received a natural shampoo containing lavender and eucalyptus essential oils, chamomile infusion, natural liquid soap, and apple cider vinegar; Group B (control), which was treated with a commercial antiparasitic shampoo with an insecticidal component; and Group C (placebo), which received a neutral shampoo without active substances. The treatment was carried out twice with a 7-day interval. The animals' condition was monitored for 21 days, with indicators recorded on days 1, 7, 14, and 21 of the study (Figure 1).

The main criteria for evaluating efficacy were the number of external parasites, the condition of the skin and coat, and behavioral reactions like itching and restlessness. During the experiment, any potential side effects and allergic reactions were recorded. A general clinical examination of the animals was conducted both before and after the study. To assess the efficacy in parasite-infested animals, the shampoo was applied in an even layer, after which the cats were allowed to groom themselves, often without the use of water, to test the product's direct effect. A visual inspection and a count of the remaining active parasites were performed within the first 2, 6, and 24 hours after application. The shampoo treatment was repeated once a week for three weeks, with weekly monitoring for the presence of parasites. The formulation of the natural antiparasitic shampoo for cats includes only readily available plant-based components without synthetic additives (Table 1).

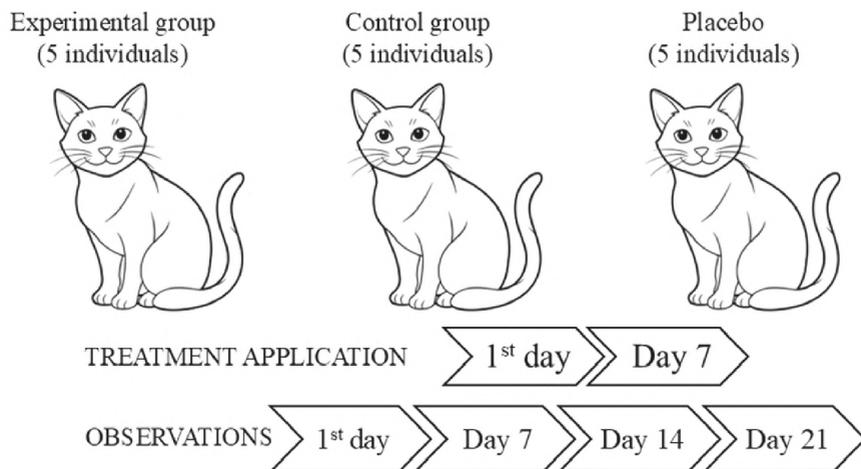


Figure 1 – Study design

Table 1 – Ingredients per 100 ml of shampoo

Component	Quantity	Destination
Lavender Essential Oil	5 drops	Antiseptic, Flea and Tick Repellent
Eucalyptus essential oil	5 drops	Antiparasitic, Antimicrobial
Concentrated Chamomile Extract (Matricaria recutita)	50 ml	Anti-inflammatory, for Skin
Liquid Soap (Fragrance-Free and SLS-Free)	40 ml	Washing Base, Natural Surfactant
3% Apple Cider Vinegar	5 ml	Repellent, Anti-itch

In small doses, essential oils are considered safe for external application in cats, but they are strictly forbidden for internal use. Therefore, the concentration of the oils in the shampoo was limited to no more than 0.5% of the total volume to eliminate the risk of toxicity. The preparation method for the shampoo included the following steps: first, a strong chamomile infusion was prepared by steeping 2 tablespoons of flowers in 100 ml of boiling water for 30 min., after which it was strained. To the resulting infusion, 50 ml of natural liquid soap, 5 drops each of lavender

and eucalyptus essential oils, and 5 ml of apple cider vinegar were added. All components were thoroughly mixed to obtain a homogeneous mass and poured into a dark glass container. The shelf life of the final product is no more than 3 weeks when stored in a refrigerator. The parasitic load was assessed by visual inspection and combing, followed by a count of the parasites. The condition of the skin and coat was evaluated using a scoring system that included parameters such as the presence of inflammation, flaking, coat sheen, and density. The study was conducted in strict compliance with veterinary ethical standards and was approved by the relevant expert commission.

Results and discussion. The study was conducted to evaluate the efficacy and safety of a newly developed natural veterinary shampoo for cats designed to combat external parasites. Based on the conducted tests, the most effective shampoo formulation was selected, which includes lavender and eucalyptus essential oils, chamomile extract, natural liquid soap, and apple cider vinegar, all of which possess antiparasitic properties and high activity against fleas and ticks. As a result of the experiment, the product demonstrated 100% efficacy in eliminating adult fleas and ticks, caused no side effects, skin irritation, or negative impact on the animals' coat, and reduced the rate of reinfestation by 40% within one week after application. Lavender has a repellent effect, along with antiseptic and soothing properties, and fights parasites, making it an excellent complement to the main active components. The essential oils were used in lower concentrations of 0.5% and 0.5%. Studies of these substances have shown that essential oil is a natural insecticide derived from lavender flowers, which has the ability to cause a rapid and powerful paralytic effect on the nervous system of parasites, leading to the death of fleas and ticks in its environment, making them safe for pets at the correct dosage. The 21-day study yielded substantiated data confirming the efficacy of the developed natural shampoo. It was found that the natural shampoo used on Group A demonstrated high efficacy in combating external parasites, with an observed reduction of 88%, which is close to the level of the traditional insecticidal agent used on Group B (92%). However, unlike in Group B, no side effects such as skin irritation, itching, or allergic reactions were recorded in any of the animals from Group A (Table 2). This confirms the safety of using the natural shampoo without the risk of developing adverse reactions.

The improvement in skin and coat condition was also more pronounced in cats from group A, averaging 4.6 and 4.5 points on a 5-point scale, respectively, which can be attributed to the emollient and healing effects of chamomile extract and essential oils. The placebo group (group C) showed only a minor reduction in parasitic load (17%) and low scores for skin and coat condition, confirming the necessity of active compo-

nents to achieve a therapeutic effect. Accordingly, the obtained data are consistent with several previously published studies highlighting the anti-parasitic efficacy of essential oils and plant extracts in veterinary practice. The favorable safety profile of the developed natural shampoo makes it a preferred choice for animals with sensitive skin or a predisposition to allergies. The study results demonstrate the high efficacy of the natural veterinary shampoo for cats in controlling external parasites without adverse effects, supporting its potential as a safe alternative to conventional insecticides in veterinary practice (Figure 2).

Table 2 - Key Indicators for the Three Study

Indicator	Group A (natural shampoo)	Group B (insecticidal shampoo)	Group C (placebo)
Average number of parasites (Day 1)	25	26	24
Average number of parasites (21 days)	3	2	20
Reducing the number of parasites, %	88%	92%	17%
Improvement of skin condition (on a 5-point scale)	4.6	3.8	2.1
Improvement of coat condition (on a 5-point scale)	4.5	3.5	2.3
Number of cases of side effects	0	3	0

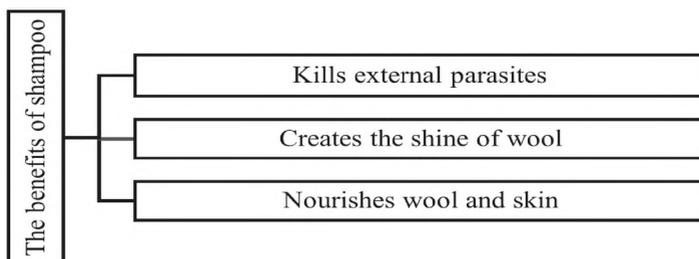


Figure 2 – Key benefits of the developed natural shampoo for cats

Conclusion. The natural shampoo developed by us, based on lavender and eucalyptus essential oils, chamomile infusion, natural liquid

soap, and apple cider vinegar, demonstrated high efficacy in controlling external parasites in domestic cats and significantly improved skin and coat condition without any adverse effects. The use of this product emphasizes its safety and highlights its potential as a promising alternative to conventional insecticidal agents, particularly within the framework of comprehensive care for animals with sensitive skin. During the development of the antiparasitic shampoo, the composition of active substances was carefully selected to ensure both high efficacy and safety for animals. Tests with different concentrations of active components were conducted, which made it possible to determine the optimal ratios to achieve maximum effectiveness without health risks for pets.

Under laboratory conditions, the shampoo successfully demonstrated a 100% efficacy rate against fleas, ticks, and lice. Following successful laboratory trials, the product was tested on domestic cats under real-life conditions, with strict adherence to the application regimen. Lavender and eucalyptus essential oils exhibited pronounced antiseptic properties, preventing inflammatory skin reactions after parasite bites. Lavender oil also had a mild soothing effect, reducing itching and irritation associated with infestations.

As a result of shampoo application, not only was complete parasite elimination observed, reaching 100% efficacy within three weeks after treatment, but a significant reduction in reinfestation rates was also achieved. In particular, during the observation period, the reinfestation rate decreased by 40%, indicating a long-term protective effect of the product. Overall analysis of the results showed that the natural shampoo reduced the parasitic burden in animals by 88% over a 21-day treatment course. Moreover, it was found suitable for use in animals of different age groups, including adult cats, thereby broadening its applicability.

The safety of the product was confirmed by the absence of adverse effects under proper use; it did not cause skin irritation, itching, or allergic reactions. This makes it not only an effective antiparasitic treatment but also a safe component of comprehensive skin and coat care for domestic pets. The highly effective antiparasitic shampoo developed represents a reliable tool for the prevention and treatment of external parasitic diseases in companion animals. Its key active ingredients, lavender and eucalyptus essential oils, provide a strong antiparasitic and antiseptic effect in combination. The product has a pleasant fragrance, is easy to apply, and does not cause irritation when used according to the recommended dosage.

Due to these characteristics, it can be widely applied both for preventive purposes and for the treatment of existing parasitic infestations. Overall, the study results confirm the high efficacy of the developed natural shampoo: all animals (100%) that underwent the treatment course were parasite-free for three weeks after the last application. Furthermore,

the product significantly reduced the risk of reinfestation in the following months due to its long-term protective effect. Based on the obtained data, conclusions can be drawn regarding its high efficacy, including an 88% reduction in parasitic burden, its versatility for animals of different age groups, and its confirmed safety when used as recommended. Thus, the developed shampoo represents a promising product for comprehensive care of domestic animals, taking into account their physiological characteristics and need for protection against external parasites.

References

- 1 Bowman D.D. *Georgis' Parasitology for Veterinarians*. - 11th edition. - 2021. - 720 p. ISBN 978-0-323-54396-5. doi: 10.1016/C2016-0-02298-2.
- 2 Chomel B.B. *Zoonoses // Reference Module in Biomedical Sciences*. – 2014. – C. B978-0-12-801238-3.02426-0. doi: 10.1016/B978-0-12-801238-3.02426-0.
- 3 Giannelli A., Schnyder M., Wright I., Charlier J. Control of companion animal parasites and impact on One Health // *One Health*. – 2024. – № 18. – C. 100679. doi: 10.1016/j.onehlt.2024.100679.
- 4 McNair C.M. Ectoparasites of medical and veterinary importance: drug resistance and the need for alternative control methods // *The Journal of Pharmacy and Pharmacology*. – 2015. – № 67 (3). – C. 351-363. doi: 10.1111/jphp.12368.
- 5 Muhammad A., Bashir R., Mahmood M., et al. Epidemiology of Ectoparasites (Ticks, Lice, and Mites) in the Livestock of Pakistan: A Review // *Frontiers in Veterinary Science*. – 2021. – № 8. – C. 780738. doi: 10.3389/fvets.2021.780738.
- 6 Shah A., Shah S.R., Rafi M.A., et al. Identification of the prevalent ticks (Ixodid) in goats and sheep in Peshawar, Pakistan // *Journal of Entomology and Zoology Studies*. – 2015. – № 3 (2). – C. 11-14.
- 7 Khan S.S., Ahmed H., Afzal M.S., et al. Epidemiology, Distribution and Identification of Ticks on Livestock in Pakistan // *International Journal of Environmental Research and Public Health*. – 2022. – № 19 (5). – C. 3024. doi: 10.3390/ijerph19053024.
- 8 Mehlhorn H. *Encyclopedia of Parasitology*. — 4th edition. — Berlin: Springer Berlin, Heidelberg, 2016. - 3084 c. ISBN 978-3-662-43978-4. doi: 10.1007/978-3-662-43978-4.
- 9 Campbell S., Soman-Faulkner K. *Antiparasitic Drugs [Electronic resource] // StatPearls*. - Treasure Island (FL): StatPearls Publishing, 2025. - Access mode: <https://www.ncbi.nlm.nih.gov/books/NBK544251/>, free.
- 10 Nametov A., Karmaliyev R., Kadraliyeva B., et al. Natural Antiseptics in Veterinary Practice: Evaluation of Efficacy and Safety // *Pathogens*. – 2025. – № 14. – C. 321. doi: 10.3390/pathogens14040321.
- 11 Chudzicka-Strugała I., Gołębowska I., Brudecki G., et al. Demodicosis in Different Age Groups and Alternative Treatment Options-A Review // *Journal of clinical medicine*. – 2023. – № 12 (4). – C. 1649. doi: 10.3390/jcm12041649.
- 12 Mathachan S.R., Sardana K., Khurana A. Current Use of Ivermectin in Der-

matology, Tropical Medicine, and COVID-19: An Update on Pharmacology, Uses, Proven and Varied Proposed Mechanistic Action // *Indian Dermatol Online J.* – 2021. – № 12 (4). – С. 500-514. doi: 10.4103/idoj.idoj_298_21.

13 *Ebani V.V., Mancianti F.* Use of Essential Oils in Veterinary Medicine to Combat Bacterial and Fungal Infections // *Veterinary sciences.* – 2020. – № 7 (4). – С. 193. doi: 10.3390/vetsci704193.

14 *Nehme R., Andrés S., Pereira R.B., et al.* Essential Oils in Livestock: From Health to Food Quality // *Antioxidants (Basel).* – 2021. – № 10 (2). – С. 330. doi: 10.3390/antiox1002330.

15 *Miguel M.G.* Antioxidant and anti-inflammatory activities of essential oils: a short review // *Molecules.* – 2010. – № 15 (12). – С. 9252-9287. doi: 10.3390/molecules15129252.

16 *Valdivieso-Ugarte M., Gomez-Llorente C., Plaza-Díaz J., et al.* Antimicrobial, Antioxidant, and Immunomodulatory Properties of Essential Oils: A Systematic Review // *Nutrients.* – 2019. – № 11 (11). – С. 2786. doi: 10.3390/nu11112786.

17 *Ebani V.V., Najar B., Bertelloni F., et al.* Chemical Composition and In Vitro Antimicrobial Efficacy of Sixteen Essential Oils against *Escherichia coli* and *Aspergillus fumigatus* Isolated from Poultry // *Veterinary sciences.* – 2018. – № 5 (3). – С. 62. doi: 10.3390/vetsci5030062.

18 *Marchese A., Barbieri R., Coppo E., et al.* Antimicrobial activity of eugenol and essential oils containing eugenol: A mechanistic viewpoint // *Critical reviews in microbiology.* – 2017. – № 43 (6). – С. 668-689. doi: 10.1080/1040841X.2017.1295225.

19 *Shah G., Shri R., Panchal V., et al.* Scientific basis for the therapeutic use of *Cymbopogon citratus*, stapf (Lemon grass) // *Journal of advanced pharmaceutical technology & research.* – 2011. – № 2 (1). – С. 3-8. doi: 10.4103/2231-4040.79796.

20 *Auezov M., Pernebekova G.A., Auezov N.S., et al.* Comparative analysis of antimicrobial properties of medicinal plants used in veterinary medicine // *Caspian Journal of Environmental Sciences.* – 2024. – № 22 (5). – С. 1043-1053. doi: 10.22124/cjes.2024.8071.

21 *Nametov A., Karmaliyev R., Kadraliyeva B., et al.* Natural Antiseptics in Veterinary Practice: Evaluation of Efficacy and Safety // *Pathogens.* – 2025. – № 14 (4). – С. 321. doi: 10.3390/pathogens14040321.

Абылай М.¹, Сансызбай А.Р.², Есимсиитова З.Б.¹

¹әл-Фараби атындағы Қазақ Ұлттық университеті, Алматы қ., Қазақстан

²Қазақ Ұлттық аграрлық университеті, Алматы қ., Қазақстан

СЫРТҚЫ ПАРАЗИТТЕРГЕ ҚАРСЫ ҮЙ ЖАНУАРЛАРЫНА АРНАЛҒАН ТАБИҒИ СУСАБЫН ЖАСАУ

Түйіндеме. Мақалада мысықтарға арналған табиғи ветеринарлық сусабынның алдын алу және сыртқы паразиттерге қарсы күреске бағытталған кешенді өзiрлеу процесi ұсынылған. Рецептураның негiзiне лаванда мен эвкалипттің эфир майлары, түймедақ тұнбасы, табиғи сұйық сабын және алма сiрке суы сияқты қауiпсiз әрi тиiмдi өсiмдiк тектi компоненттер алынған. Бұл ингредиенттер айқын антисептикалық, қабынуға қарсы және паразитке қарсы қасиеттерге ие болып, жануарлардың терiсi мен жүн жамылғысына нәзiк

әрі тиімді әсер етеді. Рецептіні жасау барысында мысықтардың физиологиялық ерекшеліктеріне ерекше назар аударылып, терапиялық тиімділік пен қолдану қауіпсіздігі арасындағы оңтайлы теңгерімге қол жеткізілді. Өзірлеу процесінде сапа мен тиімділікті бағалаудың заманауи зертханалық әдістері пайдаланылып, сондай-ақ ветеринарлық тәжірибе жағдайында практикалық сынақтар жүргізілді. Нәтижелер сусабынның сыртқы паразиттерді жоюда, үй жануарларының терісі мен жүнінің жағдайын жақсартуда жоғары тиімділігін, сондай-ақ жанама реакциялар мен тітіркенулердің болмауын растады. Алынған деректер бұл құралды профилактикалық шаралар аясында да, үй мысықтарындағы паразиттік ауруларды емдеу кезінде де, әсіресе жұқтыру қаупі жоғары жағдайда қолданудың болашағы зор екенін көрсетеді. Өзірленген сусабын ветеринарлық тәжірибеде жануарларды кешенді күтіп-бағудың сенімді құрамдас бөлігіне айналып, олардың денсаулығын нығайтуға және өмір сапасын арттыруға ықпал ете алады.

Түйінді сөздер: паразитке қарсы сусабын, паразиттер, бүргелер, кенелер, қауіпсіз өнім, эфир майлары, фитотерапия, түймедақ, алма сірке суы.

* * *

Абылай М.¹, Сансызбай А.Р.², Есимсиитова З.Б.¹

¹Қазахский Национальный университет имени аль-Фараби, г. Алматы, Казахстан

²Қазахский Национальный аграрный университет, г. Алматы, Казахстан

РАЗРАБОТКА АНТИПАЗИТАРНОГО ШАМПУНЯ ПИТОМЦАМ ДЛЯ ЭФФЕКТИВНОЙ ЗАЩИТЫ ОТ НАРУЖНЫХ ПАЗИТИВ

Аннотация. В статье представлен комплексный процесс разработки натурального ветеринарного шампуня для кошек, предназначенного для профилактики и борьбы с внешними паразитами. В основу рецептуры положены безопасные и эффективные компоненты растительного происхождения, такие как эфирные масла лаванды и эвкалипта, настое ромашки, натуральное жидкое мыло и яблочный уксус. Эти ингредиенты обладают выраженными антисептическими, противовоспалительными и антипаразитарными свойствами, что обеспечивает бережное, но действенное воздействие на кожу и шерсть животных. При создании рецепта особое внимание уделялось физиологическим особенностям кошек, что позволило добиться оптимального баланса между терапевтической эффективностью и безопасностью применения. В процессе разработки использовались современные лабораторные методы оценки качества и эффективности, а также проведены практические испытания в условиях ветеринарной практики. Результаты подтвердили высокую эффективность шампуня в устранении внешних паразитов, улучшении состояния кожи и шерсти питомцев, а также отсутствие побочных реакций или раздражений. Полученные данные свидетельствуют о перспективности использования данного средства как в рамках профилактических мероприятий, так и при лечении паразитарных заболеваний у домашних кошек, особенно в условиях повышенного риска заражения. Разработанный шампунь может стать надежным компонентом комплексного ухода за животными в

ветеринарной практике, способствуя укреплению их здоровья и повышению качества жизни питомцев.

Ключевые слова: антипаразитарный шампунь, паразиты, блохи, клещи, безопасное средство, эфирные масла, фитотерапия, ромашка, яблочный уксус.

Information about the authors

Abylai Margulan – student, Al-Farabi Kazakh National University, abylainargulan@gmail.com

Sansyzbai Abylai – Doctor of Veterinary Sciences, Professor, Kazakh National Agrarian University, Almaty c., Kazakhstan, sansyzbai-ar@mail.ru

Yessimsiitova Zura – Candidate of Biological Sciences, Professor, Al-Farabi Kazakh National University, Almaty c., Kazakhstan, zura1958@bk.ru

Авторлар туралы мәліметтер

Абылай Марғұлан – студенті, әл-Фараби атындағы Қазақ Ұлттық университеті, Алматы қ., Қазақстан, abylainargulan@gmail.com

Сансызбай Абылай Рысбайұлы – ветеринария ғылымдарының докторы, профессор, Қазақ Ұлттық аграрлық университеті, Алматы қ., Қазақстан, sansyzbai-ar@mail.ru

Есимсиитова Зура Беркутовна – биология ғылымдарының кандидаты, профессор, әл-Фараби атындағы Қазақ Ұлттық университеті, Алматы қ., Қазақстан, zura1958@bk.ru

Сведения об авторах

Абылай Марғұлан – студент, Казахский Национальный университет им. аль-Фараби, г. Алматы, Республика Казахстан, abylainargulan@gmail.com

Сансызбай Абылай Рысбаевич – доктор ветеринарных наук, профессор, Казахский Национальный аграрный университет, г. Алматы, Казахстан, sansyzbai-ar@mail.ru

Есимсиитова Зура Беркутовна – кандидат биологических наук, профессор, Казахский Национальный университет им. аль-Фараби, г. Алматы, Казахстан, zura1958@bk.ru