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O'zbekiston Respublikasi Oliy attestatsiya komissiyasi Rayosatining 2025-yil 13-iyundagi №371/5-son qarori bilan 16.00.00 — Veterinariya fanlari hamda 2026-yil 5-martdagi №382/5-son qarori bilan 06.00.00 — Qishloq xo'jaligi fanlari bo'yicha dissertatsiyalar asosiy ilmiy natijalarini chop etish tavsiya etilgan milliy ilmiy nashrlar ro'yxatiga kiritilgan.

O'zbekiston Respublikasi Prezidenti Administratsiyasi huzuridagi Axborot va ommaviy kommunikatsiyalar agentligining 16.08.2022-yildagi №1701-sonli guvohnomasi asosida nashr etiladi.

MUASSIS VA HAMKOR TASHKILOTLAR • FOUNDER & PARTNER INSTITUTIONS



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**VETERINARIYA ILMIY-TADQIQOT
INSTITUTI**
16.00.00



**PAXTA SELEKSIYASI, URUG'CHILIGI
VA YETISHTIRISH
AGROTEKNOLOGIYALARI
ILMIY-TADQIQOT INSTITUTI**
06.00.00

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JURNAL HAQIDA

MUASSIS VA NOSHIR	“Ilm-fan va innovatsiyalar akademiyasi” MChJ, O‘zbekiston. OAK ro‘yxati bo‘yicha hamkor tashkilotlar: Veterinariya ilmiy-tadqiqot instituti (16.00.00) hamda Paxta seleksiyasi, urug‘chiligi va yetishtirish agroteknologiyalari ilmiy-tadqiqot instituti (06.00.00).
RO‘YXATDAN O‘TISH	O‘zbekiston Respublikasi Prezidenti Administratsiyasi huzuridagi Axborot va ommaviy kommunikatsiyalar agentligi tomonidan berilgan 16.08.2022-yildagi №1701-sonli guvohnoma. Jurnal 2022-yildan nashr etiladi.
OAK QARORLARI	O‘zbekiston Respublikasi Oliy attestatsiya komissiyasi Rayosatining 2025-yil 13-iyundagi №371/5-son (16.00.00 — Veterinariya fanlari) va 2026-yil 5-martdagi №382/5-son (06.00.00 — Qishloq xo‘jaligi fanlari) qarorlari bilan jurnal dissertatsiyalar asosiy ilmiy natijalarini chop etish tavsiya etilgan milliy ilmiy nashrlar ro‘yxatiga kiritilgan (oak.uz).
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Ushbu to‘plamdan “Research Focus” xalqaro ilmiy jurnalining 2026-yil 7-soniga (5-jild) qabul qilingan ilmiy maqolalar o‘rin olgan.

Jurnalda O‘zbekiston Respublikasi va xorijiy oliy ta‘lim muassasalari professor-o‘qituvchilari, mustaqil ilmiy izlanuvchilari, doktorantlari va magistrantlari tomonidan olib borilayotgan ilmiy-tadqiqot ishlari natijalari ilmiy maqola tarzida chop etiladi. Shuningdek, jurnalga ilmiy-tadqiqot institutlari, ishlab chiqarish tashkilotlari va korxonalarda faoliyat ko‘rsatayotgan tadqiqotchilarning maqolalari ham qabul qilinadi.

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Eslatma! To‘plamga kiritilgan ilmiy maqolalardagi raqamlar, hisob-kitoblar va ma‘lumotlarning haqqoniyligi hamda keltirilgan iqtiboslarning to‘g‘riligi uchun mualliflar shaxsan javobgardirlar.

TAHRIRIYAT

— BOSH MUHARRIR

Saloydinov Sardorjon Qodirjon o'g'li — “Ilm-fan va innovatsiyalar akademiyasi” MChJ, O'zbekiston.

06.00.00 — QISHLOQ XO'JALIGI FANLARI

— TAHRIR HAY'ATI RAISI

Raxmankulov Murod Said-Akbarovich, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti direktori, O'zbekiston.

— RAIS O'RINBOSARLARI

Rashidova Dilbar Karimovna, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “Organik paxtachilik” laboratoriyasi mudiri, O'zbekiston.

Suvanov Boymurod Uralovich, qishloq xo'jaligi fanlari doktori (DSc), katta ilmiy xodim — Ozuqa ekinlari ilmiy-tajriba stansiyasi Agrotexnika va o'simliklarni himoya qilish bo'limi boshlig'i, O'zbekiston.

Durdiyev Normat Hasanovich, qishloq xo'jaligi fanlari doktori (DSc) — “Toshkent irrigatsiya va qishloq xo'jaligini mexanizatsiyalash muhandislari instituti” Milliy tadqiqot universiteti “Gidromeliorativ tizimlardan foydalanish” kafedrası dotsenti, O'zbekiston.

— TAHRIR HAY'ATI A'ZOLARI

Sherov Anvar Gulamovich, texnika fanlari doktori (DSc), professor — “Toshkent irrigatsiya va qishloq xo'jaligini mexanizatsiyalash muhandislari instituti” Milliy tadqiqot universiteti “Gidromeliorativ tizimlardan foydalanish” kafedrası mudiri, O'zbekiston.

Abduraxmanov Ubaydulla Zulfiqorovich, qishloq xo'jaligi fanlari doktori (DSc), katta ilmiy xodim — O'zbekiston Respublikasi Fanlar akademiyasi huzuridagi Oliy attestatsiya komissiyasi kotibiyatining qishloq xo'jaligi va veterinariya fanlari bo'yicha bosh inspektori, O'zbekiston.

Karimov Xusniddin Nagimovich, qishloq xo'jaligi fanlari doktori (DSc), katta ilmiy xodim — Akademik M.Mirzayev nomidagi Bog'dorchilik, uzumchilik va vinochilik ilmiy-tadqiqot instituti “O'simliklar fiziologiyasi va agrokimyo” laboratoriyasi mudiri, O'zbekiston.

Allanov Xolik Keldiyorovich, qishloq xo'jaligi fanlari doktori (DSc) — Toshkent davlat agrar universiteti Agronomiya va agrotexnologiyalar kafedrası professori, O'zbekiston.

Nabiev Saydig'ani Muxtorovich, biologiya fanlari doktori (DSc), professor — O'zbekiston Respublikasi Fanlar akademiyasi Genetika va o'simliklar eksperimental biologiyasi instituti laboratoriya mudiri, loyiha rahbari, O'zbekiston.

Baboev Saidmurat Kimsanboevich, biologiya fanlari doktori (DSc), professor — O'zbekiston Respublikasi Fanlar akademiyasi Genetika va o'simliklar eksperimental biologiyasi instituti “Donli ekinlar genetikasi, seleksiyasi va urug'chiligi” laboratoriyasi mudiri, O'zbekiston.

Nazarov Xudayberdi Kuydimuratovich, qishloq xo'jaligi fanlari doktori (DSc) — Toshkent davlat agrar universiteti “Qishloq xo'jaligi ekinlari genetikasi, seleksiyasi va urug'chiligi” kafedrası dotsenti, O'zbekiston.

Gafarova Aziza Israilovna, texnika fanlari bo'yicha falsafa doktori (PhD) — “Toshkent irrigatsiya va qishloq xo'jaligini mexanizatsiyalash muhandislari instituti” Milliy tadqiqot universiteti katta o'qituvchisi, O'zbekiston.

Ganiyev Sanjar Ernazarovich, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD), dotsent — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti Toshkent filiali Agrobiologiya va dorivor o'simliklar yetishtirish kafedrası dotsenti, O'zbekiston.

Idrisov Xusanjon Abdujabborovich, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD), dotsent — Farg'ona davlat universiteti Mevachilik va sabzavotchilik kafedrası dotsenti, O'zbekiston.

Mamedov Normuxammad Mardanovich, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD) — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “Organik paxtachilik” laboratoriyasi katta ilmiy xodimi, O'zbekiston.

Yakubov Muzaffar Matyakubovich, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD) — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “Organik paxtachilik” laboratoriyasi katta ilmiy xodimi, O'zbekiston.

Yaxyoeva Nafisa Nuriddinovna, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD) — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “Aqli qishloq xo'jaligi texnologiyalari” laboratoriyasi katta ilmiy xodimi, O'zbekiston.

Mamatqulova Lobar O'rolovna, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD) — Termiz davlat muhandislik va agrotexnologiyalar universiteti Agronomiya, seleksiya va urug'chilik kafedrası katta o'qituvchisi, O'zbekiston.

Rayimberdiyev Xolyigit Abduraxmanovich, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti Sirdaryo ilmiy-tajriba stansiyasi direktori, O'zbekiston.

Xamidova Shaxnoza Muxamadxanovna, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD) — “Toshkent irrigatsiya va qishloq xo'jaligini mexanizatsiyalash muhandislari instituti” Milliy tadqiqot universiteti “Gidromeliorativ tizimlardan foydalanish” kafedrasida dotsenti, O'zbekiston.

Gadayev Nodirjon Nosirjonovich, texnika fanlari bo'yicha falsafa doktori (PhD) — “Toshkent irrigatsiya va qishloq xo'jaligini mexanizatsiyalash muhandislari instituti” Milliy tadqiqot universiteti “Gidromeliorativ tizimlardan foydalanish” kafedrasida dotsenti, O'zbekiston.

Raximov Avazbek Xolmamatovich, qishloq xo'jaligi fanlari doktori (DSc), katta ilmiy xodim — Toshkent davlat agrar universiteti O'quv-ilmiy tajriba bo'limi bosh mutaxassisi, O'zbekiston.

Avtonomov Viktor Aleksandrovich, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti Markerlarga asoslangan g'o'za navlari seleksiyasi laboratoriyasi mudiri, O'zbekiston.

Amanturdiyev Alisher Balkibovich, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti laboratoriya mudiri, O'zbekiston.

Amanturdiyev Shavkat Balkibaevich, qishloq xo'jaligi fanlari doktori (DSc), katta ilmiy xodim — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti Bida seleksiyasi va urug'chiligi laboratoriyasi mudiri, O'zbekiston.

Kozubaev Shuxrat Sattardjanovich, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “G'o'za urug'chiligi va urug'shunosligi” laboratoriyasi mudiri, O'zbekiston.

Jalolov Xurshidbek Xurram o'g'li, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti ilmiy kotibi, O'zbekiston.

Avliyakov Mirzoolim Avazovich, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “Aqlli qishloq xo'jaligi texnologiyalari” laboratoriyasi mudiri, O'zbekiston.

Kurbonov Abrorjon Yorkinovich, qishloq xo'jaligi fanlari doktori (DSc), katta ilmiy xodim — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “G'o'za biotexnologiyasi” laboratoriyasi mudiri, O'zbekiston.

Negmatova Surayyo Teshaevna, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti bosh ilmiy xodimi, O'zbekiston.

Ravshanov Azam Erkinovich, qishloq xo'jaligi fanlari doktori (DSc), katta ilmiy xodim, professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti Tola texnologiyasi laboratoriyasi mudiri, O'zbekiston.

Tungushova Dilbar Abdukayumovna, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti Agroinnovatsiyalar va trening markazi bo'lim boshlig'i, O'zbekiston.

Xalikova Maloxat Babamuradovna, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti laboratoriya mudiri, O'zbekiston.

Xalikov Baxodir Meylikovich, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti laboratoriya mudiri, O'zbekiston.

Nurmatov Sheramat, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti “Tuproqni eroziyadan himoya qilish, uning meliorativ holatini yaxshilash va agroekologiya” laboratoriyasi yetakchi ilmiy xodimi, O'zbekiston.

Babaev Yashin Amanovich, qishloq xo'jaligi fanlari doktori (DSc), professor — Paxta seleksiyasi, urug'chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti direktorining ilmiy ishlar va innovatsiyalar bo'yicha o'rinbosari, O'zbekiston.

Axtamova Munira Tuychiyevna, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD) — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti “Xususiy zootexniya va yaylov chorvachiligi” kafedrasida assistenti, O'zbekiston.

Mamatov Baxtiyor Salimovich, qishloq xo'jaligi fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Qorako'lchilik va cho'l ekologiyasi ilmiy-tadqiqot instituti “Cho'l-yaylov qo'ychiligi” bo'limi mudiri, O'zbekiston.

16.00.00 — VETERINARIYA FANLARI

— TAHRIRIYAT KENGASHI RAISI

Yuldoshev Xojiakbar Toshpo'latovich, biologiya fanlari bo'yicha falsafa doktori (PhD) — Veterinariya ilmiy-tadqiqot instituti direktori, O'zbekiston.

— TAHRIRIYAT KENGASHI A'ZOLARI

Azimov Jaloliddin Azimovich, biologiya fanlari doktori (DSc), professor — O'zbekiston Respublikasi Fanlar akademiyasi akademigi, Zoologiya instituti, O'zbekiston.

Djabbarov Shuxrat Abdumajidovich, veterinariya fanlari doktori (DSc), professor — Veterinariya va chorvachilikni rivojlantirish qo'mitasi, O'zbekiston.

Safarov Alisher Abduqahor o'g'li, biologiya fanlari doktori (DSc), dotsent — Veterinariya va chorvachilikni rivojlantirish qo'mitasi, O'zbekiston.

Yunusov Xudonazar Beknazarovich, biologiya fanlari doktori (DSc), professor — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti, O'zbekiston.

Mavlanov Sabirjon Ibodullaevich, veterinariya fanlari doktori (DSc), professor — Baliqchilik ilmiy-tadqiqot instituti, O'zbekiston.

Daminov Asadullo Suvonovich, veterinariya fanlari doktori (DSc), professor — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti, O'zbekiston.

Yuldoshev Nurbek Ergashevich, veterinariya fanlari doktori (DSc), professor — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti Toshkent filiali, O'zbekiston.

Ruzimurodov Muxiddin Axrorovich, veterinariya fanlari nomzodi, professor — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

— TAHRIR HAY'ATI A'ZOLARI

Salimov Xait Salimovich, veterinariya fanlari doktori (DSc), professor — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Gafurov Aktam Gafurovich, veterinariya fanlari doktori (DSc), professor — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Elmurodov Bozorboy Aktamovich, veterinariya fanlari doktori (DSc), professor — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Mamadullayev Gulmurod Hamidovich, veterinariya fanlari doktori (DSc), professor — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Kuldoshev Otamurod Urazovich, veterinariya fanlari doktori (DSc), professor — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Eshburiyev Baxtiyar Mamatqulovich, veterinariya fanlari doktori (DSc), professor — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti, O'zbekiston.

Salimov Ilxom Xayitovich, veterinariya fanlari doktori (DSc), professor — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Eshburiyev Sobir Baxtiyorovich, veterinariya fanlari doktori (DSc), dotsent — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti, O'zbekiston.

Qurbonov Feruz Enadullaevich, veterinariya fanlari doktori (DSc), dotsent — Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti, O'zbekiston.

Djurayev Olimjon Axrorovich, veterinariya fanlari nomzodi, katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Ismatova Ra'no Asadovna, veterinariya fanlari nomzodi, katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Bo'tayev Maxmud Qarshievich, veterinariya fanlari nomzodi, katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Axmedov Baxadir Nazarovich, veterinariya fanlari nomzodi, katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Pulotov Faxriddin Sayfiddinovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Ulug'muradov Azamat Daminovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Isayev Jasur Muaffarovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Navruzov Nurali Itolmasovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Safarov Xurshid Abdurajabovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Murodov Xurshid Uktamovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Hamroqulov Nuriddin Shokir o'g'li, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Baliyev Shavkat Kuchkarovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Karimova Nazira Umukulovna, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Sultonova Intizor Yuldosheva, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

Raximov Muxamad Yunusovich, veterinariya fanlari bo'yicha falsafa doktori (PhD), katta ilmiy xodim — Veterinariya ilmiy-tadqiqot instituti, O'zbekiston.

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16.00.00 — ВЕТЕРИНАРНЫЕ НАУКИ

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Asalarilarda Amerika va Yevropa chirish kasalliklariga qarshi kurashish choralarining samaradorligini baholash

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M. Yu. RAXIMOV¹, **Sh. K. BALIYEV¹**, **X. A. SAFAROV¹**, **K. Sh. AKRAMOV¹**

¹ Scientific-Research Institute of Veterinary, Uzbekistan

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)

ENGLISH

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Abstract. The study aimed to evaluate the clinical and epizootiological characteristics of American foulbrood and European foulbrood in honey bees and to assess the practical effectiveness of veterinary-sanitary and therapeutic control measures. Investigations were conducted at the Scientific-Research Institute of Veterinary and in different beekeeping farms. The epizootiological situation was assessed in affected and conditionally healthy colonies using clinical observation, laboratory diagnostics, and epizootiological monitoring. The findings indicated that the long-term persistence of *Paenibacillus* larvae spores in the environment complicates elimination of American foulbrood infection sources. European foulbrood was characterized mainly by damage to unsealed brood and by a more pronounced course under nutritional deficiency and unfavorable hive microclimate. Colonies infested with *Varroa destructor* showed a more severe clinical course of foulbrood. Veterinary measures, including transferring affected colonies to disinfected hives, removing contaminated combs, disinfection, and queen replacement, produced favorable practical outcomes. Antibiotic treatments reduced clinical signs, but uncontrolled use is inappropriate because of the risks of antimicrobial resistance and residues in bee products. Whey-based treatments showed promising supportive effects at the early stages of European foulbrood. Overall, combined biosecurity and veterinary-sanitary measures were identified as the central approach to disease control.

Keywords: beekeeping; American foulbrood; European foulbrood; *Paenibacillus* larvae; *Melissococcus plutonius*; *Varroa destructor*; biosecurity; shook swarm method

O'ZBEKCHA

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Annotatsiya. Tadqiqotning maqsadi asalarilarda Amerika chirishi va Yevropa chirishining klinik-epizootologik xususiyatlarini baholash hamda ularga qarshi qo'llaniladigan veterinariya-sanitariya va davolash tadbirlarining amaliy samaradorligini tahlil qilishdan iborat. Tadqiqotlar Veterinariya ilmiy-tadqiqot instituti sharoitida va turli asalarichilik xo'jaliklarida olib borildi. Epizootik holat nosog'lom va shartli sog'lom asalari oilalarini klinik kuzatish, laboratoriya diagnostikasi va epizootologik monitoring asosida baholandi. Natijalar Amerika chirishida *Paenibacillus* larvae sporalarinin tashqi muhitda uzoq saqlanishi infeksiya o'chog'ini bartaraf etishni murakkablashtirishini ko'rsatdi. Yevropa chirishi, asosan, ochiq naslni zararlashi hamda oziqa tanqisligi va noqulay mikroiklim sharoitlarida kuchayishi bilan tavsiflandi. *Varroa destructor* invaziyasi mavjud oilalarda kasalliklarning klinik kechishi og'irlashgani kuzatildi. Kasallangan oilalarni dezinfeksiya qilingan uyalarga ko'chirish, zararlangan mumkataklarni chiqarib tashlash, dezinfeksiya va ona arini almashtirish kabi zooveterinariya tadbirlari ijobiy natija berdi. Antibiotik vositalar klinik belgilarni kamaytirgan bo'lsa-da, rezistentlik va asal mahsulotlarida qoldiq moddalar xavfi sababli ularni nazoratsiz qo'llash maqsadga muvofiq emas. Sut zardobi asosidagi ishlovlar Yevropa chirishining

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dastlabki bosqichlarida istiqbolli yordamchi yondashuv sifatida qayd etildi. Kompleks bioxavfsizlik va veterinariya-sanitariya choralari birgalikda qo'llash kasalliklarni nazorat qilishning asosiy sharti sifatida baholandi.

Kalit so'zlar: asalarichilik; Amerika chirishi; Yevropa chirishi; Paenibacillus larvae; Melissococcus plutonius; Varroa destructor; bioxavfsizlik; ko'chirish (shook swarm) usuli

РУССКИЙ

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Аннотация. Цель исследования заключалась в оценке клинико-эпизоотологических особенностей американского и европейского гнильца пчёл, а также практической эффективности ветеринарно-санитарных и лечебных мероприятий, применяемых для их контроля. Исследования проводили в условиях Научно-исследовательского института ветеринарии и в различных пчеловодческих хозяйствах. Эпизоотическую ситуацию оценивали в неблагополучных и условно благополучных пчелиных семьях с использованием клинического наблюдения, лабораторной диагностики и эпизоотологического мониторинга. Полученные данные показали, что длительное сохранение спор Paenibacillus larvae во внешней среде осложняет ликвидацию источников инфекции при американском гнильце. Европейский гнилец характеризовался преимущественным поражением открытого расплода и более выраженным течением при дефиците корма и неблагоприятном микроклимате улья. В семьях, инвазированных Varroa destructor, отмечалось более тяжёлое течение гнильцевых болезней. Переселение поражённых семей в продезинфицированные ульи, удаление заражённых сотов, дезинфекция и замена маток дали положительный практический эффект. Антибиотикотерапия уменьшала выраженность клинических признаков, однако её бесконтрольное применение нецелесообразно из-за риска антимикробной резистентности и остаточных веществ в продуктах пчеловодства. Обработки на основе молочной сыворотки показали перспективный вспомогательный эффект на ранних стадиях европейского гнильца. В целом комплексное сочетание мер биобезопасности и ветеринарно-санитарных мероприятий определено как основа эффективного контроля заболеваний.

Ключевые слова: пчеловодство; американский гнилец; европейский гнилец; Paenibacillus larvae; Melissococcus plutonius; Varroa destructor; биобезопасность; метод переселения (shook swarm)

1. KIRISH

Introduction

Asalarichilik qishloq xo'jaligining oziq-ovqat xavfsizligi va ekotizim barqarorligiga bevosita ta'sir ko'rsatuvchi muhim tarmoqlaridan biridir. Asal va boshqa biologik mahsulotlar olish bilan bir qatorda, asalari oilalari entomofil o'simliklarni changlatish orqali qishloq xo'jaligi ekinlarining hosildorligini ta'minlashda katta ahamiyatga ega. O'zbekistonda sohani rivojlantirishning tashkiliy-huquqiy asoslari O'zbekiston Respublikasi Prezidentining 2017-yil 16-oktabrdagi PQ-3327-son "Respublikamizda asalarichilik tarmog'ini yanada rivojlantirish chora-tadbirlari to'g'risida"gi qarorida belgilangan [1].

Asalari oilalarining bakterial kasalliklari orasida Amerika chirishi (American foulbrood) va Yevropa chirishi (European foulbrood) epizootologik va iqtisodiy jihatdan alohida ahamiyatga ega. Amerika chirishining etiologik agenti Paenibacillus larvae bo'lib, uning sporali shakllari tashqi muhit omillariga yuqori chidamliligi bilan tavsiflanadi [2, 3, 5]. Yevropa chirishining asosiy qo'zg'atuvchisi Melissococcus plutonius bo'lib, kasallik ko'proq ochiq nasl bosqichida namoyon bo'ladi [4, 9]. Ikkilamchi mikroflora tarkibida Paenibacillus alvei (avval Bacillus alvei) kabi bakteriyalar ham uchrashi mumkin.

Varroa destructor invaziyasi asalari oilalarining fiziologik holatini zaiflashtirishi va boshqa patogenlar bilan bog'liq kasallik jarayonlarini murakkablashtirishi mumkin [6, 7]. Shu sabab chirish kasalliklarini nazorat qilish faqat bitta davolash vositasiga tayanmasdan, epizootologik monitoring, erta diagnostika, dezinfektsiya, zararlangan materiallarni chiqarib tashlash, oilalarni to'g'ri boshqarish va bioxavfsizlik choralari bir tizimda qo'llashni talab etadi.

Ilmiy adabiyotlarda Paenibacillus larvae sporalarining uzoq muddat saqlanishi, Amerika chirishining yuqori yuquvchanligi va kasallik o'chog'ini to'liq bartaraf etishning murakkabligi ko'p bora qayd etilgan [2, 3, 5]. Yevropa chirishi esa ko'pincha bahorgi davr, oziqa yetishmovchiligi va uyadagi mikroiklimning buzilishi bilan bog'liq holda kuchayishi mumkin [4]. Antibiotiklarni uzoq muddat yoki nazoratsiz qo'llash patogenlarda rezistentlik shakllanishi hamda asal va boshqa mahsulotlarda qoldiq moddalar paydo bo'lishi xavfini oshiradi [10].

Mazkur tadqiqotning maqsadi Amerika va Yevropa chirishining klinik-epizootologik xususiyatlarini baholash, kasalliklarning Varroa destructor invaziyasi fonida kechishini tahlil qilish hamda ko'chirish (shook swarm), dezinfektsiya, medikamentoz va biologik ishlovlarning amaliy samaradorligini mavjud kuzatuv materiallari asosida baholashdan iborat.

2. MATERIALLAR VA METODLAR

Materials and methods

Tadqiqotlar Veterinariya ilmiy-tadqiqot instituti sharoitida hamda turli asalarichilik xo'jaliklarida olib borildi. Epizootik holatni baholash uchun Amerika va Yevropa chirishi bo'yicha nosog'lom hamda shartli sog'lom asalari oilalari kuzatildi. Tadqiqot yondashuvi klinik kuzatuv, laboratoriya diagnostikasi va epizootologik monitoringni o'z ichiga oldi.

Klinik kuzatuvlarda naslning umumiy holati, mum qopqoqlarining ko'rinishi, zararlangan lichinkalarning rangi, konsistensiyasi, hidi va patologik massaning cho'ziluvchanligi kabi belgilarga e'tibor qaratildi. Epizootologik baholashda kasallikning mavsumiy namoyon bo'lishi, oziqa ta'minoti, oilaning umumiy kuchi, uyadagi mikroiklim va Varroa destructor invaziyasi bilan bog'liq holatlar hisobga olindi.

Qarshi kurash choralarini baholashda kasallangan oilalarni dezinfeksiya qilingan yangi uyalariga ko'chirish, eski va zararlangan mumkatalarni chiqarib tashlash, dezinfeksiya tadbirlari, ona arini almashtirish, dastlabki materialda ko'rsatilgan antibiotikli siroplar hamda sut zardobi asosidagi ishlovlardan keyingi klinik holat kuzatildi. Dastlabki qo'lyozmada tajriba guruhlarining aniq soni, laboratoriya protokollarining batafsil tavsifi va statistik tahlil mezonlari berilmaganligi sababli samaradorlik ushbu maqolada sifat jihatdan tavsiflandi.

3. NATIJALAR

Results

3.1. Amerika chirishining klinik-epizootologik xususiyatlari

Kuzatuvlarda Amerika chirishi bilan zararlangan oilalarda kasallikning yozgi davrda, havo harorati yuqori bo'lgan va tabiiy asal yig'imi kamaygan sharoitlarda faolroq namoyon bo'lishi qayd etildi. Bu holat oziqa tanqisligi va asalari oilalarining fiziologik zo'riqlishi bilan birga kechgan.

Klinik tekshiruvlarda zararlangan lichinkalarda jigarrang yopishqoq massa hosil bo'lishi, mum qopqoqlarining ichkariga botishi va teshilishi, ayrim hollarda o'ziga xos yelim hidi sezilishi kuzatildi. Chirigan massaning ipga o'xshab cho'zilishi Amerika chirishini boshqa nasl kasalliklaridan differensial ajratishda muhim klinik belgi sifatida baholandi. Ushbu kuzatuvlar *Paenibacillus* larvae bilan bog'liq Amerika chirishining klassik tavsiflariga mos keladi [3, 9].

3.2. Yevropa chirishining klinik-epizootologik xususiyatlari

Yevropa chirishi, asosan, ochiq naslni zararlashi bilan tavsiflandi. Kasallik ko'proq bahor mavsumida va oziqa yetishmovchiligi mavjud oilalarda kuzatildi. Zararlangan lichinkalarda sarg'ayish, namlanish, segmentatsiyaning yo'qolishi, nordon hid va patologik massaning Amerika chirishiga nisbatan kuchsizroq cho'ziluvchanligi qayd etildi.

Patologik massa nisbatan tez uzilishi va katakchalardan osonroq ajralishi bilan farq qildi. Ayrim holatlarda *Paenibacillus alvei* kabi ikkilamchi bakterial mikroflora ishtiroki kasallikning klinik ko'rinishini murakkablashtirishi mumkinligi hisobga olindi. Bu belgilar *Melissococcus plutonius* bilan bog'liq Yevropa chirishining klinik tavsiflariga mos keladi [4, 9].

3.3. Varroatoz fonida kasalliklarning kechishi

Varroa destructor bilan invazyalangan asalari oilalarida chirish kasalliklarining klinik kechishi og'irroq bo'lgani kuzatildi. Bunday oilalarda lichinkalar nobud bo'lishining ko'payishi, oilaning tez zaiflashishi va kasallik belgilari qisqa muddatda kengroq namoyon bo'lishi qayd etildi. Ushbu holat Varroa destructor kanasining asalari salomatligiga ko'p omilli salbiy ta'siri hamda ikkilamchi infeksiyalar bilan bog'liq xavflar haqidagi ma'lumotlar bilan mos keladi [6, 7].

3.4. Qarshi kurash chora-tadbirlarining amaliy natijalari

Zooveterinariya tadbirlari orasida kasallangan oilalarni dezinfeksiya qilingan uyalariga ko'chirish (shook swarm / peregon usuli) amaliy jihatdan ijobiy natija ko'rsatdi. Eski va zararlangan mumkatalarni chiqarib tashlash, ona arini almashtirish va uyalarini o'z vaqtida dezinfeksiya qilish infeksiya manbalarini kamaytirishga hamda sog'lom nasl rivojlanishini tiklashga yordam berdi.

Dastlabki tadqiqot materialida tetratsiklin, eritromitsin va streptomitsin kabi antibiotik preparatlar qo'llanilganda klinik belgilarning kamayishi va nasl tiklanishi kuzatilgani qayd etilgan. Biroq bunday preparatlarni uzoq muddat yoki nazoratsiz qo'llash mikroorganizmlarda rezistentlik rivojlanishi, asalari ichak mikrobiotasining buzilishi va asal mahsulotlarida qoldiq moddalar paydo bo'lishi bilan bog'liq xavflarni kuchaytirishi mumkin [10]. Shu

sabab antibiotiklardan foydalanish faqat amaldagi veterinariya talablari va mahsulot xavfsizligi me'yorlariga muvofiq amalga oshirishi lozim.

Sut zardobi asosidagi biologik ishlovlar Yevropa chirishining dastlabki bosqichlarida ijobiy yordamchi natija ko'rsatdi. Dastlabki materialga ko'ra, bunday ishlovlarning afzalligi ekologik xavfsizlik va iqtisodiy qulaylik bilan bog'langan. Biroq ushbu yondashuvning samaradorligini tasdiqlash uchun nazorat guruhlarini, aniq dozalar, takrorlar va statistik tahlil keltirilgan qo'shimcha tajribalar zarur.

3.5. Dastlabki qo'lyozmada keltirilgan davolash sxemasi



1-rasm. Dastlabki materialda keltirilgan antibiotik bilan ishlov berish tartibi / **Fig. 1.** Antibiotic treatment procedure as presented in the primary study material

Izoh: antibiotik preparatlarini amaliy qo'llashda amaldagi veterinariya talablari, antimikrob rezistentlik xavfi va asal mahsulotlaridagi qoldiq moddalar bo'yicha cheklavlar hisobga olinishi lozim.

4. MUHOKAMA

Discussion

Olingan natijalar Amerika va Yevropa chirishini nazorat qilishda kasallik etiologiyasi va epizootologik xususiyatlarini hisobga olgan kompleks yondashuv zarurligini ko'rsatadi. Amerika chirishida sporali qo'zg'atuvchining uzoq muddat saqlanishi oddiy simptomatik davolashning yetarli emasligini tushuntiradi. Shu bois zararlangan materiallarni chiqarib tashlash, dezinfeksiya va sanitariya rejimini qat'iy yuritish kasallik zanjirini uzishda asosiy choralar qatoriga kiradi [2, 3, 5].

Yevropa chirishida kasallikning ochiq naslda namoyon bo'lishi, oziqa va mikroiklim omillariga sezgirligi oilani umumiy mustahkamlash choralarini muhim qiladi [4]. Tadqiqotda Varroa destructor invazyasi mavjud oilalarda chirish kasalliklari og'irroq kechgani kuzatildi; bu asalari salomatligiga bir vaqtning o'zida bir necha stress omili ta'sir qilishi mumkinligini ko'rsatadi [6, 7].

Antibiotik preparatlarini klinik belgilarni vaqtincha kamaytirishi mumkin, biroq ular sporali infeksiya manbaini to'liq bartaraf etmaydi. Bundan tashqari, rezistentlik va qoldiq moddalar muammosi asalari kasalliklarida kimyoviy davolash imkoniyatlarini cheklaydi [10]. Shuning uchun medikamentoz yondashuvlar bioxavfsizlik, sanitariya, epizootologik nazorat va xo'jalik boshqaruvi bilan birga ko'rib chiqilishi kerak.

Mazkur tadqiqot klinik-amaliy va epizootologik kuzatuvlarga tayangan holda kasalliklarni nazorat qilish choralarining amaliy ahamiyatini ko'rsatdi. Olingan natijalarni yanada chuqurlashtirish uchun keyingi tadqiqotlarda standart diagnostika protokollari, oldindan belgilangan natija mezonlari, nazorat guruhlarini va statistik tahlil rejasidan foydalanish maqsadga muvofiq.

5. XULOSA

Conclusion

1. Amerika chirishi *Paenibacillus* larvae qo'zg'atuvchisining chidamli sporali shakllari bilan bog'liq bo'lib, infeksiya manbalarini uzoq muddat saqlab qolishi mumkin; Yevropa chirishi esa asosan ochiq naslni zararlashi va oziqa hamda mikroiklim omillariga sezgirligi bilan tavsiflanadi. *Varroa destructor* invazyasi mavjud oilalarda chirish kasalliklarining klinik kechishi og'irlashishi kuzatildi.

2. Kasalliklarni nazorat qilishda oilalarni dezinfeksiya qilingan uyalarga ko'chirish, zararlangan mumkataklarni chiqarib tashlash, dezinfeksiya, ona arini almashtirish va umumiy bioxavfsizlik choralarni birgalikda qo'llash amaliy jihatdan maqsadga muvofiq.

3. Antibiotik preparatlar klinik belgilarni kamaytirishi mumkin, biroq rezistentlik va mahsulotlarda qoldiq moddalar xavfi ularning nazoratsiz qo'llanilishini cheklaydi. Sut zardobi asosidagi ishlovlar yordamchi yondashuv sifatida istiqbolli bo'lsa-da, ularning samaradorligini miqdoriy va statistik jihatdan tasdiqlovchi qo'shimcha nazoratli tajribalar talab etiladi.

DECLARATIONS

Declarations

Author contributions ORCID

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Ethics approval

The study was conducted in accordance with the veterinary-sanitary and biosecurity requirements in force in the Republic of Uzbekistan, within the framework of routine diagnostic and practical observations carried out in beekeeping farms. The work involved no human participants and no experiments on regulated vertebrate animals.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Beekeeping is an important branch of agriculture in Uzbekistan, contributing both to the production of honey and other bee products and to the pollination of entomophilous crops. The organisational and legal basis for developing the sector is defined by Presidential Resolution PQ-3327 of 16 October 2017. Among the bacterial diseases of honey

bee colonies, American foulbrood and European foulbrood are of particular epizootiological and economic importance. American foulbrood is caused by *Paenibacillus* larvae, whose spore forms are highly resistant to environmental factors, while European foulbrood is caused primarily by *Melissococcus plutonius* and manifests mainly in the unsealed brood stage. Secondary microflora such as *Paenibacillus alvei* may complicate the clinical picture. Infestation with *Varroa destructor* weakens the physiological state of colonies and may aggravate disease processes associated with other pathogens. The aim of this study was to evaluate the clinical and epizootiological characteristics of American and European foulbrood, to analyse their course against a background of *Varroa destructor* infestation, and to assess the practical effectiveness of the shook swarm method, disinfection, medicinal treatment and biological treatment on the basis of the available observational material.

Materials and methods

The investigations were carried out at the Scientific-Research Institute of Veterinary and in various beekeeping farms. To assess the epizootiological situation, colonies affected by American and European foulbrood and conditionally healthy colonies were observed. The methodological approach combined clinical observation, laboratory diagnostics and epizootiological monitoring. Clinical examination focused on the general condition of the brood, the appearance of the wax cappings, and the colour, consistency, odour and ropiness of the pathological mass of affected larvae. Epizootiological assessment took into account the seasonal manifestation of the disease, feed supply, general colony strength, hive microclimate and the presence of *Varroa destructor* infestation. The evaluation of control measures was based on the clinical state observed after transferring affected colonies into disinfected hives, removing old and contaminated combs, carrying out disinfection, replacing queens, and applying the antibiotic syrups and whey-based treatments described in the primary material. Because the primary manuscript did not report the exact number of experimental groups, a detailed description of the laboratory protocols, or the criteria used for statistical analysis, effectiveness is described here in qualitative rather than quantitative terms.

Results and discussion

In colonies affected by American foulbrood the disease was more active during the summer period, at high air temperatures and when the natural honey flow had declined; this coincided with feed shortage and physiological stress in the colonies. Clinical examination revealed the formation of a brown viscous mass in affected larvae, sunken and perforated wax cappings and, in some cases, a characteristic glue-like odour. The thread-like ropiness of the decayed mass was assessed as an important clinical sign for differentiating American foulbrood from other brood diseases, in agreement with the classical descriptions of *Paenibacillus* larvae infection. European foulbrood was characterised mainly by damage to the unsealed brood, occurred more frequently in spring and in colonies with insufficient feed, and presented with yellowing, moistening and loss of segmentation of the larvae, a sour odour and weaker ropiness than in American foulbrood; the pathological mass broke more readily and separated more easily from the cells. In colonies infested with *Varroa destructor* the clinical course of foulbrood was more severe, with increased larval mortality, rapid weakening of the colony and a broader manifestation of clinical signs within a short period. Among the veterinary measures, transferring affected colonies into disinfected hives (the shook swarm or peregona method) gave a practically favourable outcome; removing old and contaminated combs, replacing the queen and disinfecting hives in good time helped to reduce the sources of infection and to restore healthy brood development. Antibiotic preparations such as tetracycline, erythromycin and streptomycin were reported to reduce clinical signs and restore the brood, but their long-term or uncontrolled use may increase the risk of resistance, disturbance of the bee gut microbiota and residues in bee products; their use must therefore comply with current veterinary requirements and product safety standards. Whey-based biological treatments gave a favourable supportive result at the early stages of European foulbrood, their advantages being ecological safety and economic convenience, although confirmation of their effectiveness requires additional experiments with control groups, defined doses, replicates and statistical analysis.

Conclusion and contribution

American foulbrood is associated with the resistant spore forms of *Paenibacillus* larvae and may retain sources of infection for a long time,

whereas European foulbrood mainly damages the unsealed brood and is sensitive to feed and microclimate factors; in colonies infested with Varroa destructor the clinical course of both diseases was more severe. For disease control, the combined application of transferring colonies into disinfected hives, removing contaminated combs, disinfection, queen replacement and general biosecurity measures is practically expedient. Antibiotic preparations may reduce clinical signs, but the risks of resistance and of residues in bee products limit their uncontrolled use; whey-based treatments are promising as a supportive approach, although additional controlled experiments confirming their effectiveness in quantitative and statistical terms are required. The contribution of this work lies in bringing together the clinical, epizootiological and management aspects of foulbrood control in the conditions of Uzbek beekeeping farms and in showing that biosecurity and veterinary-sanitary measures, rather than chemotherapy alone, form the core of effective disease control.

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Methods for the diagnosis and control of dermatomycosis (saprolegniosis) in snakehead fish

Ilonbosh baliqlarida dermatomikoz (saprolegniosis)ni aniqlash va qarshi kurash usullari**Методы выявления и борьбы с дерматомикозом (сапролегниозом) у рыб-змееголовов****Sh. K. BALIYEV¹ , N. A. SULAYMANOVA¹**¹ *Scientific-Research Institute of Veterinary, Uzbekistan***ARTICLE INFO****ARTICLE TYPE**

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)**ENGLISH****Sh. K. BALIYEV¹ , N. A. SULAYMANOVA¹**¹ *Scientific-Research Institute of Veterinary, Uzbekistan*

Abstract. This article comprehensively analyses the biology of snakehead and eel-like fish (representatives of the Channidae family and the Anguilliformes order), as well as their high economic and dietary importance in modern intensive fisheries and aquaculture. The article provides a general description of the main fish species cultivated industrially worldwide and discusses in detail the chemical composition of fish meat, including amino acids essential for human health, omega-3 fatty acids, and the balance of micro- and macroelements. The main part of the study is devoted to one of the most pressing problems in eel fish farming today — fungal diseases, particularly dermatomycosis (saprolegniosis) caused by representatives of the Saprolegnia family. The article scientifically describes the course of this infection in eel-like fish, the patterns of its spread in aquatic environments, the ecological and ethological factors contributing to the disease, and its specific clinical signs. In addition, modern ichthyopathological methods for combating dermatomycosis in snakehead and eel-like fish, as well as technologies for the application of chemical and biological preparations, are systematized. Practical recommendations have been developed for fish farms aimed at improving water quality, carrying out liming procedures (using calcium oxide and calcium hydroxide), implementing disinfection measures, and enhancing fish immunity, thereby increasing production efficiency.

Keywords: eel; snakehead fish; aquaculture; fish farming; dermatomycosis; saprolegniosis; Saprolegnia; fungus; ichthyopathology; fish meat composition; omega-3; amino acids; intensive fish farming; water reservoir sanitation; liming; calcium oxide; prevention; clinical signs; pathogenesis; mycelium; zoospore; fish diseases; treatment methods; antiseptic; therapy

O'ZBEKCHA**BALIYEV Sh.K.¹ , SULAYMANOVA N.A.¹**¹ *Veterinariya ilmiy-tadqiqot instituti, O'zbekiston*

Annotatsiya. Ushbu ilmiy maqolada ilonbosh va ilonbaliqlar (Channidae oilasi va Anguilliformes turkumi vakillari) biologiyasi, ularning zamonaviy intensiv baliqchilikdagi va akvakulturadagi yuqori iqtisodiy hamda dietik ahamiyati kompleks ravishda tahlil qilingan. Maqolada dunyo miqyosida sanoat usulida yetishtirilayotgan asosiy baliq turlarining umumiy tavsifi va baliq go'shtining kimyoviy tarkibi, inson salomatligi uchun zarur bo'lgan aminokislotalar, omega-3 kislotalari, mikro- va makroelementlar balansi batafsil yoritilgan. Tadqiqotning asosiy qismi ilonbaliqchilik tarmog'ining bugungi kundagi dolzarb muammolaridan biri bo'lgan zamburug'li kasalliklarga, xususan, Saprolegnia oilasi vakillari tomonidan qo'zg'atiladigan dermatomikoz (saprolegniosis) kasalligiga bag'ishlangan. Maqolada ushbu infeksiyaning ilonbaliqlar organizmida kechishi, suv havzalari bo'ylab tarqalish qonuniyatlari, kasallikni keltirib chiqaruvchi ekologik va etologik omillar hamda o'ziga xos klinik belgilari ilmiy asoslangan holda bayon etilgan. Shuningdek, ilonbosh va ilonbaliqlarda dermatomikoz patologiyasiga qarshi kurashishda zamonaviy ixtiopatologik usullar, kimyoviy va biologik preparatlarni qo'llash texnologiyalari tizimlashtirilgan. Baliqchilik xo'jaliklari uchun suv muhitini sog'lomlashtirish, ohaklash (kalsiy oksidi va gidroksidi), dezinfeksiya tadbirlarini o'tkazish va

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baliqlar immunitetini oshirishga qaratilgan amaliy tavsiyalar ishlab chiqilgan bo'lib, ular ishlab chiqarish samaradorligini oshirishga xizmat qiladi.

Kalit so'zlar: ilonbaliq; ilonbosh; akvakultura; baliqchilik; dermatomikoz; saprolegnioz; Saprolegnia; zamburug'; ixtiopatologiya; baliq go'shti tarkibi; omega-3; aminokislotalar; intensiv baliqchilik; suv havzalari sanitariyasi; ohaklash; kalsiy oksidi; profilaktika; klinik belgilar; patogenez; mitseliy; zoospora; baliq kasalliklari; davolash usullari; antiseptik; terapiya

РУССКИЙ

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Аннотация. В данной научной статье комплексно проанализированы биология змееголовых и угреобразных рыб (представителей семейства Channidae и отряда Anguilliformes), а также их высокая экономическая и диетическая значимость в современной интенсивной рыбоводческой отрасли и аквакультуре. В статье приведена общая характеристика основных видов рыб, выращиваемых в промышленных масштабах во всём мире, подробно освещены химический состав рыбного мяса, содержание необходимых для здоровья человека аминокислот, жирных кислот омега-3, а также баланс микро- и макроэлементов. Основная часть исследования посвящена одной из актуальных проблем современной отрасли разведения угреобразных рыб — грибковым заболеваниям, в частности дерматомикозу (сaprolegниозу), вызываемому представителями семейства Saprolegnia. В статье научно обоснованно изложены особенности течения данной инфекции в организме угреобразных рыб, закономерности её распространения в водоёмах, экологические и этологические факторы, способствующие возникновению заболевания, а также характерные клинические признаки. Кроме того, систематизированы современные иктиопатологические методы борьбы с дерматомикозом у змееголовых и угреобразных рыб, технологии применения химических и биологических препаратов. Разработаны практические рекомендации для рыбоводческих хозяйств, направленные на оздоровление водной среды, проведение известкования (оксидом и гидроксидом кальция), дезинфекционных мероприятий и повышение иммунитета рыб, что способствует повышению эффективности производства.

Ключевые слова: угреобразные рыбы; змееголов; аквакультура; рыбоводство; дерматомикоз; saprolegnioz; Saprolegnia; грибок; иктиопатология; состав рыбного мяса; омега-3; аминокислоты; интенсивное рыбоводство; санитария водоёмов; известкование; оксид кальция; профилактика; клинические признаки; патогенез; мицелий; зооспора; болезни рыб; методы лечения; антисептик; терапия

1. KIRISH

Introduction

Zamonaviy global oziq-ovqat xavfsizligini ta'minlashda akvakultura va intensiv baliqchilik tarmoqlari yetakchi o'rinlardan birini egallab kelmoqda. Dunyo aholisining tez sur'atlar bilan o'sib borishi, tabiiy suv havzalaridagi baliq zaxiralarning kamayishi va to'g'ri ovqatlanish madaniyatining yuksalishi sanoat usulida baliq yetishtirish texnologiyalarini jadal rivojlantirishni talab etmoqda. Bugungi kunda dunyo miqyosida sanoat usulida boqilayotgan baliq turlari juda rang-barang bo'lib, ular asosan iqlim sharoiti, suvning sho'rlanish darajasi, harorati va sun'iy oziqlantirish tizimlariga moslashuvchanligiga qarab tanlab olinadi. Global akvakulturaning asosiy qismini karpsimonlar (Cyprinidae), losossimonlar (Salmonidae), tilapiyalar (Cichlidae) va laqqasimonlar (Siluriformes) tashkil etadi. Shuningdek, so'nggi yillarda o'zining yuqori gastronomik qiymati va tashqi muhit noqulayliklariga chidamliligi bilan ajralib turadigan ilonbaliqlar (Anguillidae) va ilonboshlar (Channidae) sanoat usulida yetishtirish obyekti sifatida ommalashmoqda.

Har bir baliq turining sanoat akvakulturasidagi ulushi ularning biologik xususiyatlari va o'sish sur'atiga bog'liq. Masalan, oq amur (Ctenopharyngodon idella), do'ngpeshona (Hypophthalmichthys) va oddiy karp (Cyprinus carpio) kabi turlar o'zining o'txo'rliigi va oziqa bazasining arzonligi sababli Osiyo va Yevropa mamlakatlarida keng tarqalgan bo'lsa, kamalaksimon forel (Oncorhynchus mykiss) va Atlantika lososi (Salmo salar) yuqori harorat nazorati va kislorod resurslarini talab qiluvchi intensiv resirkulyatsion tizimlarda (UZV) yetishtiriladi. Tilapiya turlari esa issiq iqlimli hududlarda, yuqori zichlikda va antropogen yuklamalarga chidamliligi tufayli hovuzlarda hamda qafaslarda (sadoq) muvaffaqiyatli parvarish qilinmoqda.

Baliq mahsulotlarining inson ratsionidagi o'rni ularning ozuqaviy qiymati va o'ziga xos kimyoviy tarkibi bilan belgilanadi. Baliq go'shti — yuksak darajada hazm bo'luvchi, to'laqonli oqsillar, hayotiy muhim lipidlar, vitaminlar va mineral moddalarning bebaho manbayidir. Issiqlik bilan ishlov berilganda baliq oqsillari inson organizmi tomonidan 93–98 % gacha o'zlashtiriladi; bu ko'rsatkich qoramol yoki parrandachilik mahsulotlariga nisbatan sezilarli darajada yuqoridir. Baliq go'shti tarkibidagi oqsil miqdori turning biologik xususiyatlariga qarab 16 % dan 22 % gacha o'zgarib turadi. Bu oqsillar tarkibida inson organizmi mustaqil sintez qila olmaydigan barcha muhim aminokislotalar — lizin, metionin, triptofan, treonin, valin, fenilalanin, leysin va izoleytsin optimal proporsiyalarda mavjud.

Baliq go'shtining eng muhim komponentlaridan biri uning lipid qismidir. Qishloq xo'jaligi hayvonlari yog'idan farqli o'laroq, baliq yog'i xona haroratida suyuq holatda oson eriydi va tarkibida ko'p to'yinmagan yog' kislotalari, ayniqsa omega-3 guruhida kirovchi kislotalar juda ko'p. Ushbu kislotalar inson organizmida yurak-qon tomir tizimi faoliyatini yaxshilash, qondagi xolesterin miqdorini kamaytirish, miya to'qimalarining rivojlanishi va immun tizimining barqarorligini ta'minlashda fundamental rol o'ynaydi. Ayniqsa, losossimonlar, ilonbaliqlar va ayrim laqqasimonlar o'z tanasida yuqori miqdorda ushbu foydali yog'larni to'plash qobiliyatiga ega. Baliq go'shtidagi yog' miqdori turning yoshi, jinsi, mavsumi va oziqlanish xarakteriga ko'ra 0,5 % dan (kam yog'li turlar — sudak, treska) 30 % dan yuqorigacha (yog'li turlar — daryo ilonbalig'i, ayrim laqqalar) yetishi mumkin.

Kimyoviy tarkibning mikronutrientlar qismiga to'xtaladigan bo'lsak, baliq go'shti va a'zolari (ayniqsa, jigari) A, D, E kabi yog'da eruvchi vitaminlar hamda B guruhi (B₁, B₂, B₆, B₁₂) vita-

minlariga juda boy. Mineral moddalardan fosfor, kalsiy, kaliy, magniy, temir, rux, mis va selen elementlari organizm uchun biologik oson o'zlashtiriladigan shakllarda bo'ladi. Dengiz va okean akvakulturasida vakillarida, shuningdek, qalqonsimon bez faoliyati uchun o'ta zarur bo'lgan yod va flor elementlarining konsentratsiyasi yuqoridir.

Sanoat usulida yetishtirilayotgan baliqlarning go'sht sifati va uning tarkibi bevosita qo'llanilayotgan ozuqa aralashmalarining tarkibiga bog'liq. Zamonaviy baliqchilikda yuqori samaradorlikka erishish uchun aminokislotalar va lipidlar muvozanati to'g'rilangan, granulalangan ozuqalardan foydalaniladi. Bu esa baliq go'shtining tarkibidagi namlik, oqsil va yog' nisbatini doimiy bir xil me'yorda saqlash, mahsulotning tovar ko'rinishi va ta'm xususiyatlarini iste'molchi talablariga mos ravishda shakllantirish imkonini beradi. Shunday qilib, sanoat akvakulturasida nafaqat yuqori sifatli oqsil manbai, balki funksional va parhez taomlar ishlab chiqarishning asosi hisoblanadi.

2. MAVZUNING DOLZARBLIGI

Relevance of the topic

Ilonbaliqlar va ilonboshsimonlar keyingi yillarda jahon akvakulturasida eng yuqori iqtisodiy foyda keltiruvchi va istiqbolli obyektlar qatoridan mustahkam joy egalladi. Ilonbaliq (*Anguilla*) va mamlakatimiz iqlim sharoitiga moslashgan, chuchuk suv havzalarida jadal ko'payayotgan ilonbosh (*Channa argus*) baliqlari o'zining biologik xususiyatlari — atmosfera havosidan qo'shimcha nafas olish qobiliyati, suvda kislorod tanqisligiga o'ta chidamliligi va juda yuqori zichlikda yashay olish imkoniyatlari tufayli intensiv baliqchilikning eng sevimli obyektiga aylandi. Biroq baliqchilik intensivlashgan sari, ya'ni sun'iy hovuzlarda va yopiq suv aylanma tizimlarida baliq o'tqazish zichligi oshirilganda, ekologik muvozanatning buzilishi natijasida turli yuqumli, parazitlar va mikotik (zamburug'li) kasalliklar epidemiyasi kelib chiqishi xavfi ortib bormoqda. Suv havzalarida baliqlarning zich joylashishi patogen mikroorganizmlarning yuqish zanjirini osonlashtiradi va bu holat mavzuning dolzarbligini belgilab beruvchi eng asosiy omildir.

Akvakultura sanoatida iqtisodiy zararining eng katta qismi aynan davolash qiyin bo'lgan yoki kech aniqlanadigan kasalliklar hisobiga to'g'ri keladi. Ilonboshlar tabiatan yirtqich va harakatchan bo'lib, intensiv sharoitda o'zaro raqobat, saralash (graduatsiya) jarayonlari yoki no'rin texnologik aralashuvlar natijasida ularning teri qoplamasi va suzgichlari tez-tez mexanik jarohatlanadi. Terining butunligi buzilishi esa atrof-muhitda, suv qatlamida va hovuz tubidagi organik qoldiqlarda doimiy mavjud bo'lgan shartli-patogen zamburug'lar uchun ochiq kirish darvozasini yaratadi. Ushbu kasalliklar ichida dermatomikozlar, aniqrog'i *Saprolegniaceae* oilasiga mansub quyi zamburug'lar qo'zg'atadigan patologiyalar ilonbaliqchilik va ilonboshchilik xo'jaliklariga global miqyosda og'ir zarbalar yetkazmoqda.

Dermatomikoz kasalligining dolzarbligi shundaki, u nafaqat tovar baliqlarining tashqi ko'rinishi va bozor qiymatini yo'qqa chiqaradi, balki inkubatsiya sexlarida baliq uvuldirig'i va chavoqlarining ommaviy qirilib ketishiga (ba'zan 80–100 % gacha) sabab bo'ladi. Zamburug' sporallari suv muhitida har qanday haroratda ham faollashishi mumkin bo'lib, ayniqsa bahor va kuz oylarida, baliqlarning immun tizimi qishki stress yoki harorat o'zgarishi sababli zaiflashgan davrda ommaviy epizootiya shaklini oladi. Bu esa o'z navbatida baliqchilik korxonalarining barqaror rivojlanishiga va sarmoyadorlarning daromadlariga to'g'ridan-to'g'ri tahdid soladi.

Ushbu muammoning yana bir jihati shundaki, uzoq yillar davomida akvakulturada dermatomikoz va boshqa mikroorganizmlarga qarshi kurashda eng samarali vosita sifatida qo'llanib kelingan malaxit yashili (malachite green) kabi kimyoviy birikmalar o'zining kanserogen va mutagen xususiyatlari tufayli butun dunyoda, jumladan O'zbekistonda ham baliqchilikda taqiqlangan. Bu taqiq ichki va eksport bozorlariga yetkazib berilayotgan baliq mahsulotlarining ekologik tozaligi va inson salomatligi xavfsizligini ta'minlash maqsadida kiritilgan. Malaxit yashilining

muomaladan chiqarilishi natijasida ixtiopatologiya to'g'ridan-to'g'ri yangi, xavfsiz, samarali va ekologik jihatdan toza bo'lgan muqobil preparatlarni hamda profilaktika usullarini qidirib topish muammosiga duch keldi. Bugungi kunda dermatomikozga qarshi kurashish uchun faqatgina kimyoviy ishlov berish emas, balki tizimli biotexnologik usullar, hovuzlar sanitarisatsiyasi, gidrokimyoviy rejimni boshqarish (masalan, ohak yordamida pH darajasini va dezinfektsiyani nazorat qilish) va innovatsion dori vositalarini joriy etish talab etiladi.

Shunday qilib, ilonboshlarda dermatomikoz kasalligining kelib chiqish sabablarini mexanizm darajasida o'rganish, uning klinikasini erta bosqichlarda aniqlash metodikasini mukammallashtirish hamda atrof-muhitga va iste'molchilarga zarar yetkazmaydigan qarshi kurashish texnologiyalarini ishlab chiqish zamonaviy baliqchilik fani va amaliyotining eng dolzarb vazifalaridan biri hisoblanadi. Ushbu mavzuning ilmiy asosda tadqiq etilishi respublikamizda baliq yetishtirish hajmini oshirish va eksport salohiyatini mustahkamlashga bevosita xizmat qiladi.

3. DERMATOMIKOZNING ETIOLOGIYASI VA KLINIK BELGILARI

Aetiology and clinical signs of dermatomycosis

Ilonbosh baliqlarida dermatomikoz (amaliyotda ko'pincha saprolegnioz deb ham yuritiladi) — *Saprolegnia parasitica* tomonidan chaqiriladigan, teri, suzgichlar, ko'z va ba'zan chuqur mushak to'qimalarining shikastlanishi bilan tavsiflanuvchi ikkilamchi infeksiya kasalligidir.

3.1. Kasallikning tarqalishi va sabablari

Dermatomikozning keng tarqalishiga sabab bo'luvchi birlamchi omil baliq tanasining mexanik jarohatlanishidir. Ilonbaliqlar o'zlarining serharakatligi, xavf tug'ilganda hovuz tubiga yoki loyga tiqilish odati va intensiv boqilganda oziqa uchun agressiv kurashishi natijasida tez-tez bir-birini tishlaydi yoki hovuz devorlariga, moslamalariga ishqalanish orqali terisining shilliq qavatini va epidermisini shikastlaydi. Baliq terisidagi shilliq (mutsin) qavati tarkibida bakteritsid moddalar (lizotsim, immunoglobulinlar) bo'lib, u tabiiy himoya to'sig'i hisoblanadi. Shilliq qavat va epidermis shikastlanganda, suvda suzib yurgan zamburug' zoosporalari jarohatlangan joyga yopishadi (adgeziya) va bir necha soat ichida gifa (ipchalar) hosil qilib, to'qima ichiga qarab o'sa boshlaydi.

Kasallikning tarqalishida suv harorati va sifati muhim sabablardan biridir. *Saprolegnia* zamburug'lari past haroratlarda (4 °C dan 15 °C gacha) o'zlarining eng yuqori patogenlik xususiyatini namoyon etadi. Shu sababli kasallik ko'pincha qishdan keyingi bahor mavsumida, baliqlarning organizmi qishki uyqu va ochlikdan zaiflashgan, immun tizimi hali to'liq tiklanmagan davrda ommaviy tus oladi. Suvda organik moddalarning ko'payib ketishi, azotli birikmalar (ammiak, nitritlar) konsentratsiyasining ortishi, pH ko'rsatkichining keskin tebranishlari baliq uchun kuchli stress bo'lib, uning umumiy rezistentligini pasaytiradi va kasallikning hovuz bo'ylab tezkor tarqalishiga zamin yaratadi.

3.2. Klinik belgilari

Dermatomikozning klinik manzarasi o'ziga xos bo'lib, uni erta va kechki bosqichlarda vizual tarzda osongina tashxislash mumkin.

Boshlang'ich bosqich: baliq tanasining shikastlangan joylarida (ko'pincha bosh qismi, suzgichlar asosi, orqa qismi) ingichka, oqish yoki kulrang rangdagi iplar paydo bo'ladi. Tashqi ko'rinishidan bu iplar suv ostida tarqalgan mayda paxta tolasiga yoki momiqqa o'xshaydi. Baliq bu bosqichda bezovta bo'ladi, hovuz devorlariga va tubiga ishqalanib, qichishishni kamaytirishga harakat qiladi.

Rivojlangan bosqich: paxtasimon qoplamalar kengayib, o'zaro birlashadi va baliq tanasining katta qismini (ba'zan 50 % dan ortig'ini) qoplab oladi. Suv tarkibidagi loy va organik zarralar gifalarga yopishishi natijasida oq qoplama sarg'ish, jigarrang yoki to'q kulrang tusga kiradi. Suzgichlar yemirilib, faqat ularning qattiq nurlari qoladi (suzgichlar chirishi).

Og'ir bosqich: zamburug' ko'z sohasiga o'tganda ko'zning xiralashishi (katarakta) va ko'rlik kuzatiladi. Gifalar chuqur mushak qatlamlariga kirib borganda, terida yiringli, qontalash bo'lgan chuqur yaralar (yarali dermatomikoz) hosil bo'ladi. Baliq oziqlanishdan to'xtaydi, harakati sekinlashadi, suv yuzasiga yaqin joyda, oqim sust bo'lgan burchaklarda harakatsiz qalqib turadi. Nafas olishi qiyinlashadi, chunki patogen ko'pincha jabralarga ham o'tadi va nafas olish yuzasini yopib qo'yib, asfiksiyaga sabab bo'ladi. Oqibatda baliq organizmining osmoregulyatsiya (suv-tuz balansi) tizimi buzilishi va umumiy intoksikatsiya tufayli ommaviy o'lim yuz beradi.



1-rasm. Baliq tanasida zamburug' gifalarining ko'rinishi / **Fig. 1.** Appearance of fungal hyphae on the body of a fish

4. QARSHI KURASH USULLARI

Control methods

Ilonbosh (*Channa argus*) balig'ini intensiv yetishtirishda dermatomikozga qarshi kurashish murakkab va tizimli yondashuvni talab etadi, chunki bu tur o'zining biologik xususiyatlariga ko'ra an'anaviy karpsimon baliqlardan farq qiladi. Ilonbosh suv yuzasiga chiqib atmosfera havosidan nafas olishi sababli, suv yuzasida hosil bo'ladigan har qanday kimyoviy plyonkalar yoki o'tkir hidli dori vositalari uning nafas olish a'zolariga (suprabranxial organ) zarar yetkazishi mumkin. Shuning uchun qarshi kurash choralarini ehtiyotkorlik bilan, terapevtik dozalariga qat'iy rioya qilgan holda olib borilishi shart.

Qarshi kurash usullari uchta asosiy yo'nalishga bo'linadi: fizik-mexanik, kimyoviy-terapevtik va biologik usullar.

4.1. Fizik va profilaktik usullar

Eng birinchi navbatda, hovuzlardagi suv almashinuvini jadallashtirish va filtrlash tizimlarining ishini optimallashtirish zarur. Suv tubidagi organik qoldiqlar, axlatlar va ozuqa qoldiqlari mexanik usulda muntazam tozalanib turilishi shart, chunki ular zamburug'lar ko'payishi uchun ideal substrat hisoblanadi. Kasallik belgilari aniqlangan baliqlar zudlik bilan umumiy hovuzdan ajratib olinishi (karantinga olinishi) kerak — bu infeksiya zanjirini uzishga yordam beradi. Shuningdek, baliqlarni saralash va ko'chirish jarayonida ishlatiladigan barcha anjomlar (to'rlar, chelaklar) har safar dezinfeksiya qilinishi lozim.

4.2. Kimyoviy-terapevtik usullar (vannalar va ishlov berish)

Malaxit yashili taqiqlanganidan keyin, zamonaviy ixtiopatologiyada ilonboshlarni dermatomikozdan davolashda quyidagi ekologik xavfsiz va samarali kimyoviy birikmalardan foydalanilmoqda.

1. Osh tuzi (NaCl) vannalari — kasallikning boshlang'ich bosqichida eng samarali va xavfsiz usul. Baliqlarni 2–3 % li osh tuzi eritmasida (1 litr suvga 20–30 gramm tuz) 15–20 daqiqa davomida ushlab turish (vanna qilish) tavsiya etiladi. Tuz eritmasi zamburug' gifalarini suvsizlantiradi (plazmoliz), ularni o'ldiradi va ayni paytda baliq tanasida shilliq ajralishini kuchaytirib, jarohatlarning bitishini tezlashtiradi. Bu muolaja 3–5 kun davomida har kuni takrorlanadi.

2. Kaliy permanganat (KMnO_4) — kuchli oksidlovchi xususiyatga ega bo'lib, zamburug' mitseliylarini yo'q qiladi. Davolash vannalari uchun 1 : 100 000 nisbatda (100 litr suvga 1 gramm) eritma tayyorlanadi va baliqlar unda 15–30 daqiqa davomida

cho'miltiriladi. Hovuzning o'ziga to'g'ridan-to'g'ri ishlov berilganda esa konsentratsiya 1,5–2 mg/l dan oshmasligi kerak.

4.3. Biologik va immunologik usullar

Ilonboshlarning dermatomikozga chidamliligini oshirish uchun ularning ozuqa ratsioniga maxsus immunomodulyatorlar, masalan, probiotiklar va vitamin komplekslari (ayniqsa, C va E vitaminlari) qo'shiladi. Bu moddalar baliqning tabiiy immun javobini faollashtiradi, terining shilliq qavatidagi bakteritsid oqsillar sintezini kuchaytiradi; natijada jarohatlar o'z-o'zidan tez bitadi va zamburug' sporalari to'qimaga o'rnatilmaydi.

5. AMALIY TAVSIYALAR

Practical recommendations

Baliqchilik xo'jaliklarida, xususan ilonbaliq va ilonbosh yetishtiriladigan intensiv hovuzlarda dermatomikoz kasalligining oldini olish va paydo bo'lganda to'g'ri choralar ko'rish uchun quyidagi amaliy tavsiyalarga qat'iy rioya qilish lozim.

Baliqlarni tutish, saralash, bir hovuzdan ikkinchisiga o'tkazish va tashish jarayonlarida mexanik jarohatlar yetkazishni maksimal darajada kamaytirish zarur. Ishlatiladigan to'rlar turg'un, tugunsiz va yumshoq materiallardan tayyorlangan bo'lishi shart. Har qanday texnologik jarayondan so'ng, profilaktika maqsadida hovuzga past konsentratsiyali osh tuzi (0,1–0,2 %) qo'shish maqsadga muvofiq.

Hovuzlarni muntazam va to'g'ri ohaklash. Ohak (kalsiy oksidi — CaO yoki kalsiy gidroksidi — Ca(OH)_2) akvakulturada eng arzon, xavfsiz va samarali dezinfeksiyalovchi vositadir. Bahorgi va kuzgi mavsum boshlanishidan oldin, hovuzlar bo'shatilganda, ularning tubi va devorlariga 1 gektar maydonga 150–200 kg hisobidan so'ndirilmagan ohak sepilishi shart. Baliq bor hovuzlarda esa suvning pH darajasini nazorat qilgan holda, har 2 haftada bir marta kichik dozalarda (10–15 kg/ga) so'ndirilgan ohak suti ko'rinishida kiritish tavsiya etiladi. Bu suvning muhitini biroz ishqoriy tomonga suradi (pH 7,5–8,2), bu esa kislotali muhitni sevuvchi *Saprolegnia* zamburug'larining rivojlanishini tormozlaydi va suvni organik moddalardan tozalaydi.

Gidrokimyoviy monitoring. Suv tarkibidagi erigan kislorod miqdori doimiy ravishda 5 mg/l dan yuqori bo'lishi, ammiak (NH_3) miqdori 0,05 mg/l dan oshmasligi nazorat qilinishi shart. Organik moddalar to'planib qolishining oldini olish uchun hovuz tubidagi suvni va loyni davriy ravishda chiqarib tashlash (sifonlash) tizimini yo'lga qo'yish lozim.

Zichlikni me'yorlashtirish. Hovuz yoki hovuzchalarda baliq o'tqazish zichligini belgilangan normativlardan oshirib yubormaslik kerak. Haddan tashqari yuqori zichlik baliqlar o'rtasida stressni kuchaytiradi va kasallikning qisqa vaqt ichida tarqalishiga sabab bo'ladi.

Karantin va sanitariya tadbirlari. Xo'jalikka tashqaridan olib kelingan har bir yangi baliq partiyasi kamida 14–21 kun davomida alohida karantin hovuzlarida saqlanishi va ularga 5 % li tuzli vannalar yordamida antiparazitar hamda antimikotik ishlov berilishi shart. Kasallik oqibatida o'lgan baliqlar zudlik bilan hovuzdan yig'ib olinishi va xavfsiz joyda kuydirilishi yoki ohak ko'milgan chuqurlarda utilitatsiya qilinishi shart; ularning suvda qolib ketishiga yo'l qo'yimaslik kerak.

6. XULOSA

Conclusion

Ilonbaliqlar va ilonboshlar zamonaviy sanoat baliqchiligining yuqori rentabellikka ega, parhezboq va tez o'suvchi qimmatli obyektlari hisoblanadi. Ularning go'shti inson salomatligi uchun zarur bo'lgan mukammal aminokislotalar balansi hamda omega-3 ko'p to'yinmagan yog' kislotalarining boy manbayidir. Biroq ushbu baliqlarni intensiv sharoitlarda yuqori zichlikda yetishtirish texnologiyasi ularning salomatligini doimiy nazorat qilishni va birinchi navbatda mikotik kasalliklarning oldini olishni talab etadi.

Dermatomikoz kasalligi baliqlarning mexanik jarohatlanishi, past suv harorati va noqulay gidrokimyoviy sharoitlar oqibatida

rivojlanuvchi jiddiy patologiyadir. Kasallik erta bosqichlarda oq paxtasimon qoplamalar ko'rinishida namoyon bo'lib, kechki bosqichlarda chuqur to'qima nekrozlari, osmoregulyatsiyaning buzilishi va baliqlarning ommaviy nobud bo'lishiga olib keladi. Malaxit yashili kabi zararli kimyoviy moddalarning taqiqlanganligi sharoitida, dermatomikozga qarshi kurashda osh tuzi va kaliy permanganatdan to'g'ri dozalarda foydalanish hamda ozuqa ratsioniga immunomodulyatorlarni kiritish yuqori samara beradi.

Xo'jaliklarda muvaffaqiyatga erishishning bosh omili davolash emas, balki tizimli profilaktikadir. Hovuzlar tubini davriy ravishda so'ndirilmagan ohak bilan dezinfeksiya qilish, suv muhitining barqarorligini ta'minlash va baliqlarga yumshoq munosabatda bo'lish orqali dermatomikoz xavfini minimal darajaga tushirish mumkin. Ushbu ilmiy-amaliy tavsiyalarning ishlab chiqarishga to'g'ri joriy etilishi respublikamiz baliqchilik tarmoqlarining barqarorligi va iqtisodiy samaradorligini ta'minlashda muhim poydevor bo'lib xizmat qiladi.

DECLARATIONS

Declarations

Author contributions CRedit

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

The study was conducted in accordance with the veterinary-sanitary and biosecurity requirements in force in the Republic of Uzbekistan, within the framework of routine diagnostic and practical observations carried out in fish-farming enterprises. The work involved no human participants and no experiments on regulated vertebrate animals.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the authors upon reasonable request.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

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EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Aquaculture and intensive fish farming occupy a leading place in ensuring modern global food security. Rapid population growth, the decline of fish stocks in natural water bodies and rising nutritional awareness all demand the accelerated development of industrial fish production technologies. Global aquaculture is dominated by cyprinids (Cyprinidae), salmonids (Salmonidae), tilapias (Cichlidae) and catfish (Siluriformes), while eels (Anguillidae) and snakehead fish (Channidae) have recently become popular objects of industrial cultivation be-

cause of their high gastronomic value and their tolerance of unfavourable environmental conditions. Snakehead fish (*Channa argus*), which is well adapted to the climate of Uzbekistan and multiplies rapidly in freshwater bodies, is particularly attractive: it can take additional oxygen from atmospheric air, tolerates oxygen deficiency in water and survives at very high stocking densities. However, as farming intensifies and stocking density rises in artificial ponds and recirculating systems, the ecological balance is disturbed and the risk of infectious, parasitic and mycotic disease outbreaks grows. Among these, dermatomycosis — commonly called saprolegniosis and caused by lower fungi of the family Saprolegniaceae, above all *Saprolegnia parasitica* — inflicts severe damage on eel and snakehead farms worldwide. The problem is aggravated by the fact that malachite green, for many years the most effective agent against mycoses in aquaculture, has been banned in fish farming worldwide, including in Uzbekistan, because of its carcinogenic and mutagenic properties. The purpose of this article is therefore to review the biology and economic importance of snakehead and eel-like fish, to analyse the causes, spread and clinical picture of dermatomycosis in these species, and to systematize the currently available safe and ecologically acceptable methods of diagnosis, treatment and prevention.

Materials and methods

The article is an analytical review. It is based on published ichthyopathological literature on fish diseases and fish farming, on data concerning the chemical composition of fish meat and the requirements of industrial aquaculture, and on clinical observation of diseased snakehead fish in fish-farming ponds. Clinical assessment relied on the visual signs of the disease: the appearance, colour and extent of the cotton-like coating on the body and fins, the condition of the fins, the eyes and the gills, and the behaviour of the affected fish. The ecological and technological conditions associated with outbreaks were considered as well — water temperature, dissolved oxygen and ammonia content, pH, accumulation of organic matter and stocking density, together with the mechanical injuries caused by handling, grading and transfer. The control measures reviewed are grouped into three directions: physical and prophylactic measures, chemical-therapeutic treatments (baths and pond treatment) and biological or immunological approaches. Because the review does not report a controlled experiment, no experimental groups, doses tested against a control or statistical analysis are presented; the effectiveness of the measures is described qualitatively on the basis of the literature and practical observation.

Results and discussion

Dermatomycosis in snakehead fish is a secondary infection caused by *Saprolegnia parasitica* that damages the skin, fins, eyes and sometimes the deep muscle tissue. The primary predisposing factor is mechanical injury: snakehead fish are active and predatory, they bite one another when competing for feed, hide in the pond bottom or mud when disturbed, and rub against pond walls and equipment, which damages the mucous layer and the epidermis. The mucus contains bactericidal substances such as lysozyme and immunoglobulins and forms the natural protective barrier; once it is broken, waterborne zoospores adhere to the wound and within a few hours form hyphae that grow into the tissue. Water temperature and quality are the second decisive factor: *Saprolegnia* shows its highest pathogenicity at low temperatures, between 4 °C and 15 °C, so outbreaks occur mainly in spring, after the winter period, when fish are weakened by fasting and their immune system has not yet fully recovered. Accumulation of organic matter, rising concentrations of ammonia and nitrites and sharp fluctuations of pH act as strong stressors that lower general resistance and accelerate spread through the pond. Clinically the disease is easy to recognize. At the initial stage thin whitish or greyish threads resembling cotton wool appear at injured sites, most often on the head, at the base of the fins and on the back, and the fish becomes restless and rubs against the walls and bottom. At the developed stage the cotton-like coatings merge and may cover more than half of the body; silt and organic particles adhering to the hyphae turn the coating yellowish, brown or dark grey, and the fins erode until only their hard rays remain. At the severe stage the fungus reaches the eye, causing opacity and blindness, hyphae penetrate the deep muscle layers and produce purulent, haemorrhagic ulcers, the fish stops feeding, moves slowly and floats motionless near the surface in areas of weak current. Breathing becomes difficult because the pathogen frequently spreads to the gills and covers the respiratory surface, causing asphyxia; mass mortality follows from disruption of osmoreg-

ulation and general intoxication. Losses are especially heavy in hatcheries, where mortality of eggs and fry may reach 80–100 per cent. Among the control measures, physical and prophylactic ones proved fundamental: intensifying water exchange, optimizing filtration, regularly removing organic residues and feed remains from the pond bottom, isolating diseased fish in quarantine and disinfecting all nets and buckets after each use. Of the chemical treatments that remain permissible after the ban on malachite green, sodium chloride baths are the most effective and the safest at the early stage — a 2–3 per cent solution (20–30 g of salt per litre of water) for 15–20 minutes, repeated daily for three to five days, dehydrates the hyphae by plasmolysis, kills them and at the same time stimulates mucus secretion and accelerates wound healing. Potassium permanganate acts as a strong oxidizer that destroys the mycelium; therapeutic baths are prepared at a ratio of 1 : 100 000 (1 g per 100 litres) with immersion for 15–30 minutes, while direct pond treatment must not exceed 1.5–2 mg/l. Biological and immunological measures — adding probiotics and vitamin complexes, particularly vitamins C and E, to the diet — activate the natural immune response and increase the synthesis of bactericidal proteins in the skin mucus, so that wounds heal faster and spores cannot establish themselves in the tissue. Care is required with all treatments because snakehead fish breathe atmospheric air at the water surface, and chemical films or pungent preparations on the surface may damage their suprabranchial respiratory organ.

Conclusion and contribution

Eels and snakehead fish are highly profitable, fast-growing and dietetically valuable objects of modern industrial fish farming, and their meat is a rich source of a complete amino-acid balance and omega-3 polyunsaturated fatty acids. Intensive high-density cultivation, however, requires continuous health monitoring and, above all, prevention of mycotic disease. Dermatomycosis develops as a consequence of mechanical injury, low water temperature and unfavourable hydrochemical conditions; it appears at an early stage as white cotton-like coatings and at a late stage leads to deep tissue necrosis, disruption of osmoregulation and mass mortality. Now that harmful chemicals such as malachite green are banned, the correct use of sodium chloride and potassium permanganate at proper doses, together with the inclusion of immunomodulators in the diet, gives good results. The main factor of success on a farm is not treatment but systematic prevention: periodic disinfection of the pond bottom with quicklime, maintenance of a stable water environment and gentle handling of the fish can reduce the risk of dermatomycosis to a minimum. The contribution of this review lies in bringing together, for the conditions of fish farms in Uzbekistan, the biological, ecological, clinical and management aspects of saprolegniosis control, and in setting out a practical, malachite-green-free scheme of prevention and treatment that farms can apply directly.

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Distribution of cattle trematodosis pathogens in the agroecosystems of the Fergana Valley (literature review)

Farg'ona vodiysi agroekotizimlarida qoramollar trematodozlari qo'zg'atuvchilarining tarqalishi (adabiyotlar sharhi)**Распространение возбудителей трематодозов крупного рогатого скота в агроэкосистемах Ферганской долины (обзор литературы)****O. MURODULLAYEV¹, J. M. ISAYEV¹**¹ *Scientific-Research Institute of Veterinary, Uzbekistan*

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)

ENGLISH

O. MURODULLAYEV¹, J. M. ISAYEV¹¹ *Scientific-Research Institute of Veterinary, Uzbekistan*

Abstract. This article presents a literature-based review of the population and bioecological characteristics of the major trematode pathogens affecting cattle in the agroecosystems of the Fergana Valley, including *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. and *Dicrocoelium dendriticum*. The life cycles of the trematodes, their intermediate hosts, their adaptation to environmental factors and the patterns of their distribution within agroecosystems were analysed. The climatic and hydrological conditions of the Fergana Valley were found to have a significant influence on the epizootiological processes of trematode infections.

Keywords: trematodosis; fasciolosis; dicrocoeliosis; paramphistomosis; agroecosystem; population; bioecology; cattle; intermediate host; Lymnaeidae; Fergana Valley

O'ZBEKCHA

MURODULLAYEV O.¹, ISAYEV J.M.¹¹ *Veterinariya ilmiy-tadqiqot instituti, O'zbekiston*

Annotatsiya. Maqolada Farg'ona vodiysi agroekotizimlarida qoramollarda uchraydigan asosiy trematodoz qo'zg'atuvchilari — *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. va *Dicrocoelium dendriticum* ning populyatsion-bioekologik xususiyatlari adabiyotlar tahlili asosida yoritilgan. Trematodalarning rivojlanish sikli, oraliq xo'jayinlari, ekologik omillarga moslashuvi hamda agroekotizimlarda tarqalish qonuniyatlari tahlil qilingan. Farg'ona vodiysining iqlim va gidrologik sharoitlari trematodozlarning epizootologik jarayonlariga sezilarli ta'sir ko'rsatishi aniqlangan.

Kalit so'zlar: trematodoz; fassiolioz; dikroselyoz; paramfistomatoz; agroekotizim; populyatsiya; bioekologiya; qoramol; oraliq xo'jayin; Lymnaeidae; Farg'ona vodiysi

РУССКИЙ

МУРОДУЛЛАЕВ О.¹, ИСАЕВ Ж.М.¹¹ *Научно-исследовательский институт ветеринарии, Узбекистан*

Аннотация. В статье на основе анализа научной литературы рассмотрены популяционно-биоэкологические особенности основных возбудителей трематодозов крупного рогатого скота, распространённых в агроэкосистемах Ферганской долины, включая *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. и *Dicrocoelium dendriticum*. Проанализированы жизненный цикл трематод, их промежуточные хозяева, адаптация к экологическим факторам и законо-

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мерности распространения в агроэкосистемах. Установлено, что климатические и гидрологические условия Ферганской долины оказывают существенное влияние на эпизоотологические процессы трематодозов.

Ключевые слова: трематодозы; фасциолёз; дикроцелиоз; парамфистоматоз; агроэкосистема; популяция; биоэкология; крупный рогатый скот; промежуточный хозяин; Lymnaeidae; Ферганская долина

1. KIRISH

Introduction

Qoramollar trematodozlari dunyo chorvachiligida keng tarqalgan parazitlar kasalliklari qatoriga kiradi. Ushbu kasalliklar mahsuldorlikning pasayishi, o'sish va rivojlanishning sustlashuvi, reproduktiv ko'rsatkichlarning yomonlashuvi hamda iqtisodiy zararlarining ortishiga sabab bo'ladi. Trematodozlar tarqalishida parazitlar biologiyasi, oraliq xo'jayinlarning ekologiyasi va tashqi muhit omillari muhim ahamiyat kasb etadi.

Farg'ona vodiysi sug'oriladigan dehqonchilik, rivojlangan chorvachilik va murakkab irrigatsiya tizimlari bilan ajralib turadi. Ushbu sharoitlar trematodalarning rivojlanishi uchun qulay ekologik muhit yaratadi. Shuning uchun mintaqada trematodoz qo'zg'atuvchilarining populyatsion-bioekologik xususiyatlarini o'rganish muhim ilmiy va amaliy ahamiyatga ega.

2. MAVZUNING DOLZARBLIGI

Relevance of the topic

Qoramollar trematodozlari dunyoning ko'plab mamlakatlarida chorvachilikka sezilarli iqtisodiy zarar yetkazuvchi invazion kasalliklar qatoriga kiradi. Ko'plab tadqiqotchilarning ma'lumotlariga ko'ra, fassioloz va paramfistomatoz kasalliklari hayvonlarda mahsuldorlikning pasayishi, ozuqa moddalari o'zlashtirilishining buzilishi, jigar va ovqat hazm qilish tizimida patologik o'zgarishlar rivojlanishi hamda reproduktiv ko'rsatkichlarning yomonlashishiga sabab bo'ladi. Shu jihatdan trematodozlar veterinariya parazitologiyasining dolzarb muammolaridan biri hisoblanadi.

Adabiyotlarda qayd etilishicha, qoramollarda trematodozlarni asosan Fasciola hepatica, Fasciola gigantica va Paramphistomum cervi qo'zg'atadi. Ushbu parazitlarning rivojlanish sikli murakkab bo'lib, oraliq xo'jayin sifatida Lymnaeidae oilasiga mansub mollyuskalar ishtirok etadi. Trematodalarning biologik rivojlanishi harorat, namlik, yog'ingarchilik, suv havzalari va sug'orish tizimlarining holatiga bevosita bog'liq bo'lib, ularning populyatsion dinamikasi ekologik omillar ta'sirida shakllanadi.

So'nggi yillarda olib borilgan ilmiy tadqiqotlar sug'oriladigan agroekotizimlarda trematodozlarning tarqalish darajasi tabiiy yaylovlarga nisbatan yuqoriroq ekanligini ko'rsatmoqda. Ayniqsa, Markaziy Osiyo davlatlarida, jumladan O'zbekiston hududida irrigatsiya tarmoqlarining kengligi, suv resurslaridan intensiv foydalanish va chorvachilikning rivojlanishi trematodalar hamda ularning oraliq xo'jayinlari uchun qulay ekologik sharoit yaratadi.

Farg'ona vodiysi respublikaning eng yirik agroindustrial hududlaridan biri bo'lib, rivojlangan sug'orish tizimlari, sernam biotoplar va qoramolchilik xo'jaliklarining ko'pligi bilan tavsiflanadi. Bunday sharoitlar trematodoz qo'zg'atuvchilarining saqlanib qolishi va tarqalishiga xizmat qilishi mumkin. Biroq mavjud ilmiy manbalar tahlili shuni ko'rsatadiki, Farg'ona vodiysi agroekotizimlarida qoramollar trematodozlari qo'zg'atuvchilarining populyatsion tuzilishi, bioekologik xususiyatlari, mavsumiy dinamikasi hamda agroiklim omillari bilan bog'liqligi yetarli darajada o'rganilmagan.

3. ADABIYOTLAR TAHLILI

Literature review

Qoramollar trematodozlari dunyoning ko'plab mamlakatlarida keng tarqalgan invazion kasalliklardan biri hisoblanib, chorvachilikka katta iqtisodiy zarar yetkazadi. Trematodozlar

orasida fassioloz va paramfistomatoz eng muhim kasalliklar qatoriga kiradi. Ushbu kasalliklar qoramollarda mahsuldorlikning pasayishi, tana vaznining kamayishi, reproduktiv ko'rsatkichlarning yomonlashishi hamda jigar va oshqozon-ichak tizimida chuqur patologik o'zgarishlarning rivojlanishiga sabab bo'ladi [1, 2].

Ko'plab tadqiqotchilar fassiolozning tarqalishi tabiiy va sun'iy suv havzalari, nam yaylovlarda hamda sug'oriladigan agroekotizimlar bilan uzviy bog'liqligini qayd etganlar. Fassiolozning asosiy qo'zg'atuvchilari bo'lgan Fasciola hepatica va Fasciola gigantica rivojlanish siklining ma'lum bosqichlarini suv muhitida o'tkazadi. Ularning biologik rivojlanishi uchun Lymnaeidae oilasiga mansub mollyuskalar zarur bo'lib, mazkur mollyuskalar parazitlarning oraliq xo'jayinlari vazifasini bajaradi [3].

K.I. Skryabinning fundamental tadqiqotlarida trematodalarning biologiyasi, sistematikasi va rivojlanish sikllari batafsil o'rganilgan. Muallifning ta'kidlashicha, trematodalar evolyutsiya davomida tashqi muhit omillariga yuqori darajada moslashgan bo'lib, ularning rivojlanish sikli xo'jayinlar almashinuvi orqali amalga oshadi. Bu esa parazitlarning tabiatda uzoq muddat saqlanib qolishiga imkon yaratadi [4].

M.D. Soninning ma'lumotlariga ko'ra, trematodalarning populyatsion barqarorligi ularning yuqori reproduktiv potentsiali bilan bog'liq. Voyaga yetgan bitta fassiola bir sutka davomida 20–30 mingtagacha tuxum qo'yishi mumkin. Tuxumlarning katta qismi tashqi muhitga ajralib chiqib, qulay ekologik sharoitlarda rivojlanishning keyingi bosqichlariga o'tadi. Shu sababli trematodozlar epizootik jarayonining uzluksiz saqlanib qolishida parazitlarning serpushtligi muhim omil hisoblanadi [5].

A.A. Galkinning tadqiqotlarida fassiolalarning populyatsion ekologiyasi o'rganilib, ularning son dinamikasi harorat, namlik va suv havzalari holati bilan chambarchas bog'liqligi ko'rsatib berilgan. Muallifning fikricha, haroratning 20–30 °C oralig'ida bo'lishi tuxumlardan miratsidiylarning chiqishi hamda mollyuskalarda serkariyalari rivojlanishi uchun optimal sharoit yaratadi [6].

Markaziy Osiyo hududida olib borilgan tadqiqotlar natijalariga ko'ra, Fasciola gigantica issiq iqlim sharoitlariga yaxshiroq moslashganligi sababli F. hepatica ga nisbatan kengroq tarqalgan. O'zbekistonning sug'oriladigan hududlarida, ayniqsa Farg'ona vodiysi, Xorazm va Surxondaryo viloyatlarida ushbu turning ustunligi kuzatiladi [7, 8].

S. Mas-Coma va hammualiflar tomonidan olib borilgan tadqiqotlarda fassiolozning global tarqalishi va ekologik omillarga bog'liqligi tahlil qilingan. Mualliflar iqlim o'zgarishi, suv resurslaridan foydalanishning ortishi hamda antropogen omillar trematodalar va ularning oraliq xo'jayinlari arealining kengayishiga olib kelayotganligini ta'kidlaydilar [9].

Paramfistomatoz qo'zg'atuvchilari ham qoramollarda keng tarqalgan trematodalar qatoriga kiradi. Paramfistomatidalar rivojlanish siklida ham suv mollyuskalari ishtirok etadi. Voyaga yetgan parazitlar kavsh qaytaruvchilarning katta qorin bo'limida parazitlik qilsa, lichinkalik bosqichlari ichak shilliq qavatida rivojlanib, kuchli yallig'lanish va funksional buzilishlarni yuzaga keltiradi [10].

So'nggi yillarda olib borilgan tadqiqotlar irrigatsiya tizimlarining kengayishi trematodozlar epizootologiyasiga sezilarli ta'sir ko'rsatishini ko'rsatmoqda. Sug'orish kanallari, kollektor-drenaj tizimlari va sun'iy suv havzalari mollyuskalar populyatsiyasining

ortishiga sabab bo'ladi. Natijada tashqi muhitning invazion lichinkalar bilan zararlanish darajasi ortib, qoramollarning kasallanish xavfi kuchayadi [11, 12].



1-rasm. Qoramollar trematodozlari qo'zg'atuvchilarining rivojlanish sikli va ekologik bog'liqligi / **Fig. 1.** Life cycle of cattle trematodosis pathogens and its ecological dependencies

Farg'ona vodiysi agroekotizimlari yuqori antropogen yuklama, rivojlangan irrigatsiya tarmoqlari va qulay agroiklim sharoitlari bilan tavsiflanadi. Ushbu omillar trematodalar va ularning oraliq xo'jayinlari populyatsiyalarining shakllanishi hamda saqlanib qolishi uchun qulay ekologik muhit yaratadi. Shunga qaramasdan, mintaqada trematodoz qo'zg'atuvchilarining populyatsion tuzilishi, mavsumiy dinamikasi va ekologik omillar bilan bog'liqligi bo'yicha kompleks tadqiqotlar yetarli darajada amalga oshirilmagan. Bu esa mazkur yo'nalishda chuqur ilmiy izlanishlar olib borishni taqozo etadi.

4. XULOSALAR

Conclusions

1. Adabiyotlar tahlili shuni ko'rsatdiki, qoramollar trematodozlari (*Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. va boshqa turlar) chorvachilikka katta iqtisodiy zarar yetkazuvchi, keng tarqalgan invazion kasalliklar qatoriga kiradi. Ushbu parazitlarning rivojlanish sikli suv muhitlari va oraliq xo'jayinlar bilan chambarchas bog'liq bo'lib, ularning populyatsion barqarorligi yuqori reproduktiv salohiyat hamda ekologik omillarga moslashuvchanligi bilan tavsiflanadi.

2. Farg'ona vodiysining sug'oriladigan agroekotizimlari, rivojlangan irrigatsiya tarmoqlari, sernam biotoplar va qulay agroiklim sharoitlari trematodalar hamda ularning oraliq xo'jayinlari populyatsiyalarining shakllanishi va saqlanib qolishi uchun ekologik jihatdan qulay muhit yaratadi. Bu esa mintaqada trematodozlarning tabiiy va antropogenik o'choqlari barqarorligini ta'minlovchi asosiy omillardan biri hisoblanadi.

3. Trematodoz qo'zg'atuvchilari populyatsiyasining shakllanishi va epizootik jarayonning intensivligi harorat, namlik, suv havzalari holati, sug'orish tizimlarining rivojlanganligi hamda oraliq xo'jayin mollyuskalar zichligi bilan bevosita bog'liqdir. Shu sababli ushbu omillar trematodozlarning tarqalishini prognozlash va epizootik xavf darajasini baholashda muhim indikator sifatida xizmat qiladi.

4. Mavjud ilmiy manbalar tahlili Farg'ona vodiysi agroekotizimlarida trematodoz qo'zg'atuvchilarining populyatsion tuzilishi, bioekologik xususiyatlari va mavsumiy dinamikasi bo'yicha kompleks tadqiqotlar yetarli darajada olib borilmaganligini ko'rsatdi. Bu esa mintaqaviy epizootologik monitoring tizimini takomillashtirish va ilmiy asoslangan prognozlash usullarini ishlab chiqishni taqozo etadi.

5. Trematodozlarga qarshi kurashning samaradorligini oshirish uchun epizootologik monitoring, oraliq xo'jayinlar populyatsiyasini nazorat qilish, yaylov va suv manbalarining veterinariya-sanitariya holatini yaxshilash hamda profilaktik degelmintizatsiya tadbirlarini agroekologik sharoitlarni hisobga olgan holda kompleks ravishda amalga oshirish maqsadga muvofiqdir.

DECLARATIONS

Declarations

Author contributions ^{CRedit}

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

The article is a review of published scientific literature. The work involved no experiments on animals and no human participants, and therefore required no separate ethics committee approval.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data discussed in this review are taken from the publications listed in the reference list and are available from those sources.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Trematodoses of cattle are among the most widespread parasitic diseases in world animal husbandry. They reduce productivity, slow growth and development, impair reproductive performance and cause substantial economic losses. The spread of trematodoses depends on the biology of the parasites, the ecology of their intermediate hosts and environmental conditions. The Fergana Valley is distinguished by irrigated agriculture, well-developed animal husbandry and a complex irrigation network; these conditions create a favourable ecological environment for the development of trematodes. The main causative agents recorded in cattle are *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. and *Dicrocoelium dendriticum*, and their development involves molluscs of the family Lymnaeidae as intermediate hosts. Although the Fergana Valley is one of the largest agro-industrial regions of the republic, with extensive irrigation systems, humid biotopes and numerous cattle farms, analysis of the available literature shows that the population structure, bioecological characteristics, seasonal dynamics and dependence on agroclimatic factors of trematode pathogens in the agroecosystems of this region have not been studied sufficiently. The purpose of this article is therefore to review and systematize the published data on the population and bioecological characteristics of the principal cattle trematode pathogens, on their life cycles and intermediate hosts, and on the ecological conditions that determine their distribution in the irrigated agroecosystems of the Fergana Valley.

Materials and methods

The article is a literature review. It is based on the analysis of published scientific sources: classical monographs and textbooks on veterinary parasitology and helminthology, fundamental works on the biology, systematics and life cycles of trematodes, regional studies on the helminths of domestic ruminants in Uzbekistan and Central Asia, and international publications on the global distribution of fasciolosis and other plant-borne trematode zoonoses. Twelve sources were analysed. The review considered, for each group of pathogens, the morphological characteristics of the adult parasites and their eggs, the stages of the life cycle passed in the aquatic environment, the species of intermediate host molluscs involved, and the environmental factors reported to govern development and survival — temperature, humidity, precipitation, the state of water bodies and the condition of irrigation systems. Data on the agroclimatic and hydrological conditions of the Fergana Valley were compared with the ecological requirements of the parasites and their intermediate hosts described in the literature. No original experiment, sampling scheme or statistical analysis was carried out; the conclusions are based on the comparative analysis of published data.

Results and discussion

The analysis confirmed that fasciolosis and paramphistomosis are the most important trematodoses of cattle and that they cause reduced productivity, loss of body weight, impaired absorption of nutrients, deterioration of reproductive performance and deep pathological changes in the liver and the gastrointestinal tract. The distribution of fasciolosis is closely bound to natural and artificial water bodies, humid pastures and irrigated agroecosystems, because *Fasciola hepatica* and *Fasciola gigantica* pass defined stages of their life cycle in the aquatic environment and require molluscs of the family Lymnaeidae as intermediate hosts. Fundamental work on the biology and systematics of trematodes shows that these parasites are highly adapted to environmental factors and that their life cycle proceeds through an alternation of hosts, which allows them to persist in nature for long periods. Population stability is supported by a very high reproductive potential: a single adult fluke may lay up to twenty to thirty thousand eggs per day, and a large part of these eggs is shed into the environment, where under favourable ecological conditions they proceed to the following developmental stages; the fecundity of the parasites is therefore a key factor in the continuity of the epizootic process. Studies of the population ecology of *Fasciola* show that their numerical dynamics are closely linked to temperature, humidity and the state of water bodies, with a temperature range of 20–30 °C being optimal for the hatching of miracidia from eggs and for the development of cercariae in molluscs. In Central Asia, *Fasciola gigantica* is more widely distributed than *F. hepatica* because it is better adapted to a hot climate, and its predominance is observed in the irrigated regions of Uzbekistan, notably in the Fergana Valley, Khorezm and Surkhandarya. International analyses of the global distribution of fasciolosis indicate that climate change, the increasing use of water resources and anthropogenic factors are expanding the range of trematodes and their intermediate hosts. Paramphistomes are also widespread in cattle; aquatic molluscs likewise take part in their life cycle, the adult parasites occurring in the rumen of ruminants while the larval stages develop in the intestinal mucosa and cause severe inflammation and functional disturbance. Recent work shows that the expansion of irrigation systems significantly affects the epizootiology of trematodoses: irrigation canals, collector and drainage systems and artificial reservoirs increase mollusc populations, so that contamination of the environment with invasive larvae rises and the risk of infection in cattle grows. The agroecosystems of the Fergana Valley combine a high anthropogenic load, developed irrigation networks and favourable agroclimatic conditions, all of which create an ecologically favourable environment for the formation and persistence of populations of trematodes and their intermediate hosts.

Conclusion and contribution

Cattle trematodoses caused by *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. and other species are widespread invasive diseases that inflict considerable economic damage on animal husbandry; their life cycles are closely bound to aquatic environments and intermediate hosts, and their population stability rests on high reproductive potential and adaptability to environmental factors. The irrigated agroecosystems of the Fergana Valley, with their developed irrigation networks, humid biotopes and favourable agroclimatic conditions, form an ecologically favourable environment for the formation and persistence of populations of trematodes and their intermediate hosts, and this

is one of the principal factors sustaining natural and anthropogenic foci of trematodoses in the region. The formation of pathogen populations and the intensity of the epizootic process depend directly on temperature, humidity, the state of water bodies, the development of irrigation systems and the density of intermediate host molluscs, so these factors serve as important indicators for forecasting the spread of trematodoses and assessing the level of epizootic risk. The review also showed that comprehensive studies of the population structure, bioecological characteristics and seasonal dynamics of trematode pathogens in the agroecosystems of the Fergana Valley have not been carried out to a sufficient degree, which calls for improvement of the regional epizootiological monitoring system and the development of scientifically grounded forecasting methods. To increase the effectiveness of control, epizootiological monitoring, control of intermediate host populations, improvement of the veterinary-sanitary condition of pastures and water sources and preventive dehelminthization should be applied together, taking the agroecological conditions of the region into account. The contribution of this review lies in assembling, for the first time for the Fergana Valley, a consolidated picture of the pathogens, their intermediate hosts and the agroecological factors that govern them, and in identifying the specific gaps that regional field research now needs to close.

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Clinical symptoms, seasonal dynamics and diagnosis of eimeriosis

Eymeriozning klinik belgilari, mavsumiy dinamikasi va diagnostikasi

Клинические симптомы, сезонная динамика и диагностика эймериоза

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)

ENGLISH

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Abstract. This article presents the clinical signs of eimeriosis in farm animals, especially rabbits, the characteristics of the course of the disease, its outcomes and age-related data. The occurrence of the disease in rabbits by season, the results of observations on farms, the classical methods widely used for diagnosing the disease and the order of their implementation are described in sequence. In addition, guidance is given on identifying rabbits affected or unaffected by eimeriosis from their appearance, on taking anamnesis data and on performing palpation. The main information in the article was obtained by analysing literature sources and is presented in a consolidated form.

Keywords: eimeriosis; rabbit; oocyst; protozoa; schizogony; gametogony; sporogony; macrogamete; microgamete; flotation method; Fülleborn method

O'ZBEKCHA

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Annotatsiya. Ushbu maqolada qishloq xo'jaligi hayvonlarida, ayniqsa quyonlarda uchraydigan eymeriozlarning klinik belgilari, kasallikning kechish xususiyatlari, oqibatlar va yoshga bog'liq ma'lumotlar keltirilgan. Quyonlarda kasallikning yil fasllariga qarab uchrash holati, xo'jaliklardagi kuzatishlar natijalari, kasallikni aniqlashda keng qo'llaniladigan klassik usullar va ularni bajarish tartibi ketma-ketlikda bayon qilingan. Bulardan tashqari, eymerioz bilan zararlangan yoki zararlanmagan quyonlarni tashqi ko'rinishidan aniqlash, anamnez ma'lumotlarini olish va paypaslash usullarini bajarish bo'yicha yo'riqnomalar keltirilgan. Maqoladagi asosiy ma'lumotlar adabiyot manbalaridan tahlil qilib olingan va mujassamlashtirilgan holda taqdim etilgan.

Kalit so'zlar: eymerioz; quyon; oosista; protozoa; shizogoniya; gametogoniya; sporogoniya; makrogameta; mikrogameta; flotatsiya usuli; Fyulleborn usuli

РУССКИЙ

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Аннотация. В данной статье представлены клинические признаки, особенности течения заболевания, последствия и возрастные данные по эймериозу у сельскохозяйственных животных, в частности у кроликов. Последовательно описаны заболеваемость кроликов по сезонам, результаты наблюдений на фермах, классические методы, широко используемые для диагностики заболевания, и порядок их применения. Кроме того, даны рекомендации по выявлению кроликов, инфицированных или не инфицированных эймериями, по внешнему виду, по сбору анамнеза и проведению пальпаторных методов. Основная информация статьи получена в результате анализа литературных источников и представлена в обобщённом виде.

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Ключевые слова: эймериоз; кролик; ооциста; простейшие; шизогония; гаметогония; спорогония; макрогамета; микрогамета; метод флотации; метод Фюллеборна

1. KIRISH

Introduction

Bugungi kunda dunyo aholisining chorvachilik mahsulotlariga, jumladan quyon go'shti, undan tayyorlanadigan parhez oziq-ovqat, jun va teri xom ashyosiga bo'lgan talabi yildan-yilga oshib bormoqda. Ushbu talabni qondirish, yangi ish o'rinlarini yaratish va quyon go'shti ishlab chiqarish hajmini yanada oshirish muhim vazifa hisoblanadi. Eymerioz bilan kasallangan quyonlarda davolash ishlari o'z vaqtida olib borilmasa, 15–20 kun ichida quyonlarning 90 foizi nobud bo'ladi. Shunga ko'ra, turli hududlardagi quyonlarning invazion kasalliklarini aniqlash, davolash va oldini olish chora-tadbirlarini ishlab chiqish muhim ilmiy va amaliy ahamiyat kasb etadi.

2. MAVZUNING DOLZARBLIGI

Relevance of the topic

Barcha yoshdagi quyonlar eymeriyalar bilan zararlanadi. Ammo 3–4 oylikkacha bo'lgan yosh quyonchalar kasallikka ko'proq chalinadi; yoshi kattaroq va katta yoshli quyonlar kasallikka chidamliroq hisoblanadi. Kasallik 20 kunlikdan 60 kunlikkacha bo'lgan quyonlarda og'ir kechadi va o'lim bilan tugaydi. Quyonlar tug'ilishining birinchi kunidan boshlab alimantar (og'iz orqali) yo'l bilan doimiy ravishda eymeriya oosistalarini suv va oziqa bilan qo'shib yuta boshlaydi; shu tariqa 3 oylikka yetganda quyonlarda invaziyaning ekstensivligi 100 % ga yetadi.

Quyon bolalarida eymerioz turli shakllarda namoyon bo'ladi: yosh quyonlarda kasallik ko'pincha yarim o'tkir va o'tkir shaklda, katta quyonlarda esa surunkali va yashirin holda rivojlanadi. Kasallik ichakda (37,2 %) va jigarda (60,6 %) uchrashi hamda yoz faslida keng tarqalishi aniqlangan. Shuningdek, bo'g'oz va emizikli quyonlar qolganlariga qaraganda kamroq darajada zararlanishi tadqiqotlar natijasida aniqlangan. Quyonlar asosan 4 oylikdan boshlab eymeriozga chidamli bo'la boshlaydi; natijada kasallik quyonlarda uchrasa-da, uning oqibatidan nobud bo'lish holatlari kamayadi. Quyonlarning yosh guruhlarida o'tkazilgan tadqiqotlarda deyarli har bir quyon tezagina eymeriozning oosistalari qayd etilgan. Yosh hayvonlarda invaziya ekstensivligi 100 % ni tashkil qilishi hamda 120 kundan katta quyonlarda invaziya ekstensivligi 89,7 % gacha kamayishi aniqlangan.

3. ADABIYOTLAR TAHLILI

Literature review

3.1. Oosistalarning sporulyatsiyasi va mavsumiy dinamika

Yilning turli fasllarida quyonlarning eymeriya oosistalari bilan zararlanish darajasi ko'p jihatdan ularning tashqi muhitda sporalanish davriga bog'liq. Tashqi muhitda oosistalarning sporulyatsiyasi faqat harorat va namlikning ma'lum diapazonida sodir bo'ladi. Olimlarning fikriga ko'ra, 18–22 °C haroratda va to'yingan namlikda oosistalarning sporulyatsiyasi ko'p hollarda bir necha kun ichida tugaydi [1, 9, 18].

Bahorda harorat 5–15 °C da va nisbiy namlik 35–82 % bo'lganda Eimeria magna va E. media oosistalari uchun qulay sharoit yaratilib, natijada 120 soatdan keyin sporalanish yakuniga yetadi; E. perforans ushbu qulay sharoitda 59 soatda sporalanishini yakunlaydi. Yozda 15–26 °C haroratda va nisbiy namlik 30–90 % bo'lganda E. irrisidua oosistalari 54 soatdan so'ng, E. magna 54–72 soatda, E. media 54–60 soatda, E. perforans 30–36 soatda sporalanishi aniqlangan [14]. Qishda 1–30 °C haroratda deyarli barcha quyon eymeriya oosistalari sporalanmasligi, shuningdek 30 kun

ichida nobud bo'lmisligi qayd etilgan. Kasallik deyarli barcha quyonchilik fermalarida yilning barcha fasllarida uchraydi. Oosistalarning tashqi muhitda sporulyatsiya davri 24 soat davom etganligi sababli, ushbu davrdan keyin quyon najasidagi oosistalar yuqumli hisoblanadi [4].

Quyonchilik xo'jaliklarida kasallikning avj olishi ko'proq issiq mavsumda kuzatiladi, ammo quyonxona issiq bo'lsa, kasallik qishda ham paydo bo'lishi mumkin. Quyon eymeriozi yil davomida yoz faslida hamda qishda 1 oylikdan 3 oylikkacha bo'lgan quyonlarda eng ko'p uchraydi. Tadqiqotlarga ko'ra, yozda iyundan avgustgacha katta yoshli quyonlarda invaziyaning ekstensivligi 100 %, qishda invaziyaning intensivligi 67 % ekanligi aniqlangan. Qishda invaziya kamroq uchragani bilan quyonlar kasallikni og'ir o'tkazadi, natijada o'lim holatlari yuz beradi [2, 3, 12].

3.2. Qo'zg'atuvchining morfologiyasi va rivojlanish davrlari

Quyon eymeriya oosistalarining uzunligi 12 mkm dan 35 mkm gacha yetadi. Har bir oosistada 4 tadan sporoblast (sporosista) bor. Har qaysi sporosista ichida esa 2 tadan ingichka, chuvalchangsimon, harakatchan sporozoit bo'ladi. Oziqa yoki suv bilan ichakka tushgan oosistalar va sporosistalar qobig'i yemirilib, sporosistalar ichak bo'shlig'iga chiqadi va ulardan sporozoitlar ajraladi. Sporozoitlar faol harakatlanib ichak, jigar va oshqozon osti bezi hujayralariga kirib oladi hamda oziqlanib o'suvchi davrga — trofozoitlarga aylanadi. Trofozoitlar tez o'sadi, yadrosi ko'p marta ketma-ket bo'linib, ko'p yadroli shizontlarni hosil qiladi. O'z navbatida shizont ham bo'linib, ko'p sonli merozoitlarni hosil qiladi [10].

Barcha sporalilar qaysi yo'l bilan rivojlanmasin, uchta taraqqiyot davrini boshdan kechiradi. Birinchi faza — sporogoniya bosqichi bo'lib, u tashqi muhitda amalga oshadi; bu fazada oosistalar sporosistaga aylanadi va shundan keyingina invazion holatga o'tadi. Ikkinchi faza — shizogoniya: bu fazada sporosistalardan sporozoitlar hosil bo'ladi va ular quyonlarning jigar hamda ichak epiteliyal hujayralariga kiradi, u yerda bo'linish yo'li bilan merozoitlar va shizontlar hosil bo'ladi. Shizontlardan yetilgan parazitlardan makrogametalar (urg'ochi hujayralar) va mikrogametalar (erkak hujayralar) shakllanadi. Uchinchi faza — gametogoniya: bu fazada ko'payish jinsiy yo'l bilan amalga oshadi, mikrogameta ichak yo'liga yoki o't yo'liga chiqadi va makrogameta ichiga kirib uni otalantiradi. Shu yo'l bilan oosista hosil bo'ladi va oosistalar najas bilan tashqi muhitga ajraladi. Oosistalar tashqi muhitning noqulay ta'sirlariga chidamli, lekin yuqori haroratga chidamsiz: 80–100 °C da 5–10 soniyada, 55 °C da esa 15 daqiqada nobud bo'ladi [21].

3.3. Diagnostika usullari

Eymeriozning diagnostikasi epizootologik ma'lumotlar, klinik belgilar, ichakdagi patologik o'zgarishlar hamda kasallik aralash holda uchraganda jigardagi o'zgarishlar hisobga olingan holda amalga oshiriladi [15].

Kasallikka diagnoz qo'yishda hayvonlarning najasida oosistalarni topish, nobud bo'lgan hayvon ichagining shilliq qavati bo'laklarini o'rganish va mikroskopda sinchiklab ko'rib eymeriyalarni topish eng qulay usul ekanligi taklif qilingan. Bu usul yordamida ichak epiteliyal hujayralarida eymeriyalarning merozoitlari va shizontlari topiladi [7, 24].

Diagnoz qo'yishda mahalliy smear usuli qo'llaniladi. Bu diagnostikaning eng oddiy usuli bo'lib, najas surtilgan slaydga glitserin va natriy xloridning to'yingan eritmasi teng qismlaridan iborat

suyuqlikdan 2–3 tomchi qo‘shiladi va smear mikroskop ostida tekshiriladi; ushbu usulda ham eymeriya oosistalarini topish mumkin [8].

Eymerioz diagnostikasi uchun flotatsiya usullari ham tavsiya etiladi. Ushbu usullar eymeriya oosistalarini turli tuzlarning to‘yingan eritmasi yordamida aniqlashga asoslangan. Eymeriozni tashxislash uchun flotatsiya usullaridan eng keng qo‘llaniladiganlari Fyulleborn, Darling va Brez usullari bo‘lib, ular kasallikni aniqlashda oddiy, arzon va samarali ekanligi qayd etilgan [20].

Darling va Brez usullari najas namunalari qayta ishlashning qarama-qarshi usullari — cho‘ktirish va flotatsiya kombinatsiyasiga asoslangan. Buning mohiyati shundaki, najas namunasini qayta ishlashning murakkabligiga qaramay, tadqiqot uchun flotatsiya eritmasi kamroq sarflanadi, usullar tejamkorroq va natijalari samaraliroq bo‘ladi. Brez flotatsiya usulida flotatsion suyuqlik magniy sulfat, natriy tiosulfat, bir qism suv va to‘yingan eritmalarning uch qismidan tashkil topgan kombinatsiyalangan eritma hisoblanadi [25].

Qarama-qarshi usullarning bu kombinatsiyasi tufayli cho‘kindi va sirt plyonkasi eymeriya oosistalari bilan boyitiladi, suspenziyaning ortiqcha begona zararlari chiqarib tashlanadi va mikroskopiyaga xalaqit bermaydi. Suspenziyani ikki marta — avval suv bilan, so‘ngra flotatsiya eritmasi bilan sentrifugalash birinchi bosqichda markazdan qochma kuch ta’sirida oosistalarning tez cho‘kishiga, ikkinchisida esa ularning suzib chiqishiga yordam beradi [17].

Kombinatsiyalangan flotatsiya eritmasidan tashqari olimlar Goryaev kamerasi yoki Makmaster kamerasi yordamida najasdagi oosistalar sonini aniqlash usulini ham taklif qilishadi [16, 22].

Quyonglarga eymerioz tashxisini qo‘yishda sentrifugalash bilan modifikatsiyalangan Fyulleborn usulidan foydalanish klassik Fyulleborn usulidan 4,9–19,2 marta va standartlashtirilgan Darling usulidan 1,1–1,8 marta samaraliroq ekani hamda har bir namunada 3 dan 35 daqiqagacha vaqt tejash mumkinligi isbotlangan. To‘yingan natriy xlorid eritmasi o‘rniga to‘yingan natriy tiosulfat eritmasidan foydalanish modifikatsiyalangan Fyulleborn usulining samaradorligini 1,34 martaga oshiradi [5, 13, 26].

3.4. Klinik belgilar va immunitet

Ushbu kasallikni tashxislashda eymeriozning klinik belgilari ham muhim rol o‘ynaydi. Quyongning o‘ng tomoni paypaslab ko‘rilganda jigar og‘rig‘iga, ko‘rinarli shilliq qavatning kamqonligiga va jigar shikastlanishi bilan kuzatiladigan sariqlikka, qorin hajmining kattalashishiga, quyonglarda diareya, poliuriya va ozg‘inlikka alohida e’tibor berilishi kerak. Ammo ichak va jigar shaklidagi quyong eymeriozining klinik belgilarini o‘ziga xos bo‘lmagan deb hisoblash mumkin. Ushbu kasallikning eng ishonchli diagnostik mezon laboratoriya diagnostikasi usullari va patologik o‘zgarishlar hisoblanadi [6, 19].

Kasallikdan sog‘aygan quyonglarda nosteril immunitet paydo bo‘ladi. Bu immunitet quyonglar hayoti davomida saqlanib qoladi. Immunitet faqat maxsus, ya’ni kasallikni qo‘zg‘atgan eymeriya turigagina xos bo‘ladi; boshqa turning oosistalari quyong organizmiga tushganda kasallik rivojlanaveradi [11, 23].

Kasallikni diagnostika qilishda quyonglar qornining shishib ketishi, tez-tez siyishi, ichi ketishi va patologoanatomik o‘zgarishlariga qarab xulosa chiqariladi. Aniq diagnoz qo‘yish uchun kasallangan quyongning tezagi Fyulleborn usulida tekshirilib, oosistalarning bor yoki yo‘qligi mikroskop ostida aniqlanadi [27].

4. XULOSA

Conclusion

Yuqorida keltirilgan ma’lumotlar bizgacha protozoolog olimlar tomonidan eymeriyalarni o‘rganish natijalarining tahlili bo‘lib, klassik ma’lumot sifatida bugungi fan-texnika rivojlangan davrda ham o‘z dolzarbligini yo‘qotmagan. Respublikamizda quyongchilik rivojlanishning dastlabki bosqichida ekanligini hisobga olsak, ushbu sohada iqtisodiy samaradorlikni oshirish uchun mazkur

kasallikni tadbirkorlar va yosh mutaxassislar chuqur bilishlari shart, chunki eymerioz quyonglarning eng keng tarqalgan besh kasalligi sirasiga kiradi.

Adabiyotlar tahlili xulosasiga ko‘ra, eymerioz barcha tur hayvonlarda uchraydi va quyongchilik hamda parrandachilik sohalariga jiddiy xavf tug‘diradi. Kasallik asosan yosh hayvonlarda og‘ir kechadi; yoshi katta hayvonlar kasallikka chidamli bo‘lib, ular kasallik manbai sifatida xizmat qiladi. Kasallik yilning barcha fasllarida uchraydi va ayniqsa bahor hamda yoz fasllarida xo‘jaliklarga katta iqtisodiy zarar yetkazadi.

DECLARATIONS

Declarations

Author contributions *CRedit*

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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The article is a review of published scientific literature. The work involved no experiments on animals and no human participants, and therefore required no separate ethics committee approval.

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All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

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All data discussed in this review are taken from the publications listed in the reference list and are available from those sources.

Conflict of interest

The authors declare no conflict of interest.

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EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Demand for rabbit products — meat, dietary foods made from it, wool and hides — is rising year by year, and increasing the volume of rabbit meat production is an important task for the livestock sector of Uzbekistan. Eimeriosis is one of the five most common diseases of rabbits: if treatment is not carried out in time, up to 90 per cent of affected rabbits die within 15–20 days. Rabbits of all ages become infected with Eimeria, but young rabbits up to three or four months of age are affected most severely; the disease is most acute in animals between twenty and sixty days old and frequently ends in death. From the first day of life rabbits continuously ingest oocysts with water and feed by the alimentary route, so that by three months of age the prevalence of invasion reaches 100 per cent. In young rabbits the disease usually takes a sub-acute or acute form, whereas in adults it becomes chronic and latent; it is recorded in the intestine in 37.2 per cent and in the liver in 60.6 per cent of cases, and is most widespread in summer. Rabbits begin to acquire resistance from about four months of age, after which the disease still occurs but mortality falls; in animals older than 120 days the prevalence of invasion declines to 89.7 per cent. The purpose of this article is to consolidate and analyse the published data on the clinical signs,

the seasonal dynamics and the diagnostic methods of rabbit eimeriosis, and to present them as a practical reference for specialists and farmers in a sector that is still at an early stage of development in Uzbekistan.

Materials and methods

The article is a literature review. Twenty-seven sources were analysed, comprising international journal papers on the biology and immunology of *Eimeria*, classical monographs and manuals on the diagnosis of coccidiosis, and regional publications on the epizootiology of rabbit eimeriosis in Uzbekistan. For each source the review extracted data on three groups of questions: the morphology of the oocysts and the developmental cycle of the parasite; the environmental conditions — temperature and relative humidity — governing sporulation and hence the seasonal pattern of infection; and the laboratory procedures used for diagnosis, together with the reported comparative efficiency of those procedures. The diagnostic techniques considered were direct smear microscopy, the flotation methods of Fülleborn, Darling and Breza, the combined sedimentation-and-flotation approach with double centrifugation, and quantitative counting of oocysts in the Goryaev and McMaster chambers. Clinical criteria — palpation of the right side for hepatic pain, pallor of the visible mucous membranes, icterus, enlargement of the abdomen, diarrhoea, polyuria and emaciation — were assessed for their diagnostic value against laboratory findings. No original experiment was conducted; the data are presented in consolidated form.

Results and discussion

The degree of infection of rabbits with *Eimeria* oocysts in different seasons depends largely on the sporulation period in the environment, and sporulation occurs only within defined ranges of temperature and humidity. At 18–22 °C and saturated humidity sporulation is generally completed within a few days. In spring, at 5–15 °C and a relative humidity of 35–82 per cent, favourable conditions arise for the oocysts of *Eimeria magna* and *E. media*, whose sporulation is completed after 120 hours, while *E. perforans* completes sporulation in 59 hours. In summer, at 15–26 °C and a relative humidity of 30–90 per cent, the oocysts of *E. irrisidua* sporulate after 54 hours, *E. magna* in 54–72 hours, *E. media* in 54–60 hours and *E. perforans* in 30–36 hours. In winter, at temperatures around 1–30 °C, almost no rabbit *Eimeria* oocysts sporulate, yet they also do not perish within thirty days. Because the sporulation period in the environment lasts twenty-four hours, oocysts in rabbit faeces are considered infective after that interval. Outbreaks occur mainly in the warm season, but if the rabbitry is heated the disease may also appear in winter; it is most frequent in summer and, in winter, in rabbits between one and three months old. In summer, from June to August, the prevalence of invasion in adult rabbits reaches 100 per cent, whereas in winter the intensity of invasion is 67 per cent; although invasion is less frequent in winter, the disease runs a more severe course and mortality occurs. Oocysts are 12–35 µm long and each contains four sporoblasts, every sporocyst holding two motile, thread-like sporozoites. After the shells are destroyed in the intestine the sporozoites penetrate the cells of the intestine, liver and pancreas, become trophozoites, and through repeated nuclear division form multinucleate schizonts and then numerous merozoites. Development proceeds through three phases: sporogony in the external environment, by which oocysts become infective; schizogony in the epithelial cells of the liver and intestine; and gametogony, in which the microgamete fertilizes the macrogamete and the resulting oocysts are shed with the faeces. Oocysts resist adverse environmental factors but are killed by heat — within 5–10 seconds at 80–100 °C and within 15 minutes at 55 °C. Diagnosis rests on epizootiological data, clinical signs and pathological changes together with laboratory confirmation. The simplest procedure is the native smear with glycerol and saturated sodium chloride; among flotation methods those of Fülleborn, Darling and Breza are the most widely used and are simple, cheap and effective. The combined sedimentation-and-flotation approach enriches both the sediment and the surface film with oocysts while removing interfering particles, and double centrifugation — first with water, then with flotation fluid — first accelerates sedimentation and then flotation. The Fülleborn method modified by centrifugation proved 4.9–19.2 times more effective than the classical Fülleborn method and 1.1–1.8 times more effective than the standardized Darling method, saving between three and thirty-five minutes per sample; replacing saturated sodium chloride with saturated sodium thiosulphate increased its efficiency a further 1.34-fold. Clinical signs — hepatic pain on palpation of the right side, anaemia of the visible mucosae, icterus, abdominal enlargement, diarrhoea, polyuria and emaciation — are informative but not specific, so laboratory methods and pathological

findings remain the most reliable criteria. Recovered rabbits develop non-sterile, species-specific immunity that persists for life, but oocysts of a different *Eimeria* species will still cause disease.

Conclusion and contribution

The data summarized here represent the analysis of results obtained by protozoologists over many decades; as classical knowledge they have not lost their relevance in the present age of advanced science and technology. Given that rabbit farming in Uzbekistan is still at an early stage of development, a thorough understanding of this disease by entrepreneurs and young specialists is essential for raising the economic efficiency of the sector, since eimeriosis ranks among the five most important diseases of rabbits. Eimeriosis occurs in all animal species and poses a serious threat to rabbit and poultry farming; it runs a severe course mainly in young animals, while older animals are resistant and serve as a source of infection. The disease is recorded in all seasons of the year and causes particularly heavy economic losses to farms in spring and summer. The contribution of this review lies in bringing the morphological, epizootiological, clinical and laboratory aspects of rabbit eimeriosis together in a single practical reference and in identifying the modified Fülleborn method with centrifugation, using saturated sodium thiosulphate, as the most efficient diagnostic procedure currently available for farm conditions.

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Histomorphological assessment of a drug complex in experimental tuberculosis of calves

Buzoqlarning eksperimental tuberkulyozida preparatlar kompleksini gistomorfologik baholash

Гистоморфологическая оценка комплекса препаратов при экспериментальном туберкулёзе телят

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)

ENGLISH

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Abstract. The article presents the results of histological studies of the internal organs of experimental calves used in experiments to study the effects of a new complex of anti-tuberculosis drugs, Rifizostrep. It has been established that this drug, when used over a long period in animals with experimental tuberculosis, has a sufficiently high bactericidal activity against pathogens of the M. tuberculosis-7880 strain. Along with this, it was found that Rifizostrep has no side effects or negative effects on the body as a whole or on the structure of the internal organs of the experimental calves in particular.

Keywords: tuberculosis; complex preparation; Rifizostrep; internal organs; histology; morphology; structure; experimental calves; hemosiderosis

O'ZBEKCHA

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Annotatsiya. Maqolada tuberkulyozga qarshi preparatlarning yangi kompleksi «Rifizostrep»ning ta'sirini o'rganish bo'yicha sinovlarda bo'lgan tajriba buzoqlarining ichki a'zolarini gistologik tekshirish natijalari keltirilgan. Aniqlanishicha, mazkur preparat eksperimental tuberkulyozdagi hayvonlarga uzoq muddat davomida qo'llanganda kasallikning M. tuberculosis-7880 shtammiga qarshi yuqori darajadagi bakteritsid faollikka ega. Shu bilan bir qatorda, Rifizostrep tajriba hayvonlarining organizmiga umuman va ichki a'zolarining strukturaviy tuzilishiga xususan biron-bir nojo'ya yoki salbiy oqibat ko'rsatmasligi aniqlangan.

Kalit so'zlar: tuberkulyoz; kompleks preparat; Rifizostrep; ichki a'zolar; gistologiya; morfologiya; struktura; tajriba buzoqlari; gemosideroz

РУССКИЙ

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Аннотация. В статье представлены результаты гистологических исследований внутренних органов подопытных телят, находившихся в экспериментах по изучению влияния нового комплекса противотуберкулёзных препаратов «Рифизостреп». Установлено, что данный препарат при применении в течение длительного периода животным с экспериментальным туберкулёзом обладает достаточно высокой бактерицидной активностью против возбудителей заболевания из штамма M. tuberculosis-7880. Наряду с этим выявлено, что Рифизостреп не оказывает каких-либо побочных или отрицательных действий на организм в целом и на структурное строение внутренних органов подопытных телят в частности.

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Ключевые слова: туберкулёз; комплексный препарат; Рифизостреп; внутренние органы; гистология; морфология; структура; подопытные телята; гемосидероз

1. INTRODUCTION

Kirish

In the modern world tuberculosis of farm animals and birds is not only a significant problem of veterinary science and practice but also carries a considerable degree of social relevance. It is known that one of the reasons for the decrease in cattle numbers is the removal of animals that react positively during routine allergic testing on livestock farms. According to the veterinary instructions and regulations in force in Uzbekistan, all positively reacting animals must be immediately isolated from the general herd and sent for sanitary slaughter. In such testing there are also cases of positive reactions arising for various other reasons in animals that are conditionally healthy with respect to tuberculosis.

Such circumstances cause serious economic losses not only to livestock farming but also to the specialists and employees working in this field. In this regard, the development of control measures and chemical prevention of this disease remains, as before, very much in demand.

2. MATERIALS AND METHODS

Materiallar va metodlar

In order to address this problem, over the past several years the staff of the Laboratory for the Study of Animal Tuberculosis at the Scientific-Research Institute of Veterinary have conducted large-scale scientific and practical research, which resulted in the creation of a new combination of anti-tuberculosis drugs, Rifizostrep. To study in vivo the effectiveness of this new complex — that is, its antibacterial activity against mycobacteria in a living organism — an experiment was conducted jointly with the staff of the Laboratory of Pathomorphology on six calves of a black-and-white breed aged six to eight months.

Before the start of the experiment all calves were subjected to an allergic test, in which no positive reaction to tuberculin was established 72 hours after administration. All calves were then infected subcutaneously in the neck with a suspension of *M. tuberculosis*-7880 at a dose of 1 ml (0.03 mg/kg) and divided into two groups of three head. The first group was the experimental group and the second served as a control. Twenty-four days after infection, taking into account the incubation period of mycobacterial development in the animal body, the calves of the first experimental group were injected with Rifizostrep subcutaneously at a dose of 5 ml per 100 kg of live weight for 60 days at ten-day intervals. The drug was not used in the animals of the second, control group.

The total duration of the experiment was six months. At the end of the experiments, with the participation of a specially created commission, all the calves were slaughtered for diagnostic purposes, dissected and thoroughly examined pathoanatomically. Pathological material — pieces of internal organs 0.5–1 cm thick — was then taken from each experimental animal for histological and microscopic studies.

3. RESULTS

Natijalar

The heart is represented as a thick layer of striated fibres; the structure of the cardiomyocytes is clearly expressed and their sarcoplasm consists of densely arranged myofibrils.

The boundaries of the numerous hepatic lobules are poorly expressed, and their parenchyma can be determined by the location of the central veins. The vein wall consists of a single-layered epithelium and connective tissue. Haemocapillaries and hepatic plates are

located around the central veins. In stellate macrophages inside the capillaries a dark brown pigment, haemosiderin, appears in the form of small grains or clusters of them. Fine-grained chromatin is clearly visible as dust in the nuclei of the multifaceted hepatocytes. It is very important that the structure of the hepatocytes in the parenchyma and the lobules of the liver is monotonous and not subject to dystrophic changes.

In histological preparations from the kidneys the cortical part, located at the periphery of the organ and consisting of renal corpuscles and the proximal and distal sections of nephrons, passes smoothly, without pronounced boundaries, into the medullary part. The structure of the medullary part in turn is formed from the loops of Henle and the collecting tubules. The renal tubules are covered with a single layer of tall cubic cells. In some preparations small yellowish-brown grains of lipofuscin are visible in the distal parts of the nephrocytes.

Most of the parenchyma of the spleen consists of white pulp, which is observed in the form of round and oval lymphoid follicles made up of clusters of numerous lymphocytes. Numerous dilated blood vessels, mainly venous sinuses, are located in the red pulp. In the lumen of these vessels, along with the formed elements of the blood, macrophages are also visible, containing grains and sometimes lumps of the pigment haemosiderin in their cytoplasm.

The gastric mucosa is covered with a single layer of cylindrical cells, on top of which lies a mucoid secretion of a light pink colour. In the fundal part of the stomach the glands take the form of tubes, in which the covering epithelium with a mucous mass can be examined.

Histological preparations made from the small intestine are presented in the form of numerous villi and crypts beneath the mucous membrane. The surface of the finger-like and, in rare cases, leaf-like villi is covered with a single-layered cylindrical epithelium. With pink-coloured cytoplasm, these enterocytes have an elongated nucleus. In the field of view of the preparation there are also a few areas with oedema in those places where the fibres of the smooth muscle layer of the intestinal walls are loosened.

The mucous membrane of the walls of the large intestine, with its numerous folds, is represented in the form of tubular crypts. The villi of the enterocytes covering these crypts are not clearly visible. There is also a lamina propria consisting of loose fibrous connective tissue, which is subject to the diffusion of scattered lymphocytes and epithelial cells. Numerous blood vessels are located in the folds of the mucous membrane.

4. DISCUSSION

Muhokama

The results of the studies on the subcutaneous use of the new complex antibacterial drug have shown that in the body of calves, after infection with a suspension of the *M. tuberculosis*-7880 strain, Rifizostrep has a sufficiently high bactericidal and bacteriostatic activity against the pathogens. Along with this, the drug has no negative, side or toxic effects on the body of the experimental animals.

Since the picture of the general pathological autopsy and of the histological examination of the internal organs, especially the numerous lymph nodes, in the calves of the second, control group was presented in the form of the well-known pathological processes characteristic of tuberculosis, it was not considered necessary to describe these changes again here.

5. CONCLUSION

Xulosa

In order to study the effect of the new combination of anti-tuberculosis drugs, Rifizostrep was administered subcutaneously to calves at a dose of 5 ml per 100 kg of body weight for 60 days at ten-day intervals. An analysis of the histomorphological studies of the internal organs of the experimental animals showed that when Rifizostrep is used over a long period, minor structural changes develop in the form of haemosiderosis in the parenchymal organs and a slight increase in the secretion of the gastrointestinal tract.

Thus, the results of pathoanatomical and laboratory histological studies have established that the drug Rifizostrep, when used for a long time at a dose of 5 ml per 100 kg of live weight, is harmless and does not cause any damage or morphological destruction of the internal organs of calves.

DECLARATIONS

Author contributions *CRedit*

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. The author has read and agreed to the published version of the manuscript.

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Ethics approval

The experimental work on calves was carried out at the Scientific-Research Institute of Veterinary in accordance with the veterinary requirements and biosecurity rules in force in the Republic of Uzbekistan, under the supervision of a specially created commission. The study involved no human participants.

Informed consent

The author has read and approved the final version of the manuscript and has given consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the author upon reasonable request.

Conflict of interest

The author declares no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The author used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the Uzbek and Russian metadata. No text, data, figures or conclusions were generated by AI. The author reviewed and verified all output and takes full responsibility for the content of the publication.

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Pathomorphological evaluation of the antituberculosis efficacy of Rifizostrep in experimental calf tuberculosis

Tuberkulyozga qarshi Rifizostrep preparatining buzoqlar eksperimental tuberkulyozidagi patomorfologik tavsifi

Патоморфологическая оценка противотуберкулёзной эффективности препарата Рифизостреп при экспериментальном туберкулёзе телят

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ENGLISH

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Abstract. This study presents the results of pathomorphological and histomorphological investigations of the internal organs of experimental calves used in studies of the efficacy of the Rifizostrep preparation. A novel combination anti-tuberculosis drug, Rifizostrep, was developed by researchers at the Scientific-Research Institute of Veterinary. Administration of this preparation to animals demonstrated its sufficiently effective bactericidal activity against *M. tuberculosis* in experimental tuberculosis. Concurrently, it was found that Rifizostrep exerts no adverse or detrimental effects on the organism as a whole or on the structure of the internal organs of the experimental calves. Analysis indicated that prolonged administration of the preparation resulted in minor structural changes, characterized by haemosiderosis in the cellular structure of the parenchymal organs and a slight increase in gastrointestinal secretion. Based on the findings of pathomorphological and laboratory histological examinations, the preparation was established to be harmless to the animal organism and to exert no general or acute toxic effects.

Keywords: mycobacteria; tuberculosis; combination; preparation; Rifizostrep; dose; parenchymal organs; pathoanatomical; histomorphological; structure; haemosiderosis; in vivo; allergy; tuberculin

O'ZBEKCHA

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Annotatsiya. Maqolada Rifizostrep preparatining tajribadagi buzoqlar eksperimental tuberkulyozida ichki a'zoldagi patologoanatomik va gistomorfologik o'zgarishlar bo'yicha tekshirishlar natijalari bayon qilingan. Yangi kombinatsiyalangan Rifizostrep preparati Veterinariya ilmiy-tadqiqot instituti tuberkulyoz laboratoriyasi xodimlari tomonidan ishlab chiqilgan. Preparat eksperimental tuberkulyozda *M. tuberculosis* qo'zg'atuvchilariga qarshi yetarli darajada samarali bakteritsid faollikka ega ekanligi aniqlangan. Shu bilan bir qatorda, Rifizostrep hayvon organizmiga va buzoqlarning ichki a'zolari strukturasiga nomaqbul ta'sir ko'rsatmaydi. Tahlillarga ko'ra, preparat buzoqlar organizmiga uzoq vaqt davomida qo'llanilganda ichki a'zoldan nisbatan kam sonli strukturaviy o'zgarishlar — parenximatoz a'zolar hujayra strukturasida gemosideroz ko'rinishida va oshqozon-ichak traktida sekretsianing bir oz kuchayishi kabi o'zgarishlar kuzatilgan. Patologoanatomik va gistomorfologik tekshirishlar natijasiga ko'ra, preparat hayvon organizmi uchun bezarar bo'lib, umumiy va o'tkir toksik ta'sirga ega emas.

Kalit so'zlar: mikobakteriya; tuberkulyoz; kombinatsiya; preparat; Rifizostrep; doza; parenximatoz a'zolar; patologoanatomik; gistomorfologik; struktura; gemosideroz; in vivo; allergiya; tuberkulin

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РУССКИЙ

МАМАДУЛЛАЕВ Г.Х.¹ , ДЖУРАЕВ О.А.¹ , ДЖУРАКУЛОВ О.К.¹¹ Научно-исследовательский институт ветеринарии, Узбекистан

Аннотация. В данной работе представлены результаты патологоанатомических и гистоморфологических исследований внутренних органов подопытных телят, находившихся в экспериментах по изучению действия препарата Рифизостреп. Научными сотрудниками Научно-исследовательского института ветеринарии разработана новая комбинация препаратов против туберкулёза — Рифизостреп. При применении данного препарата животным установлено, что он обладает достаточно эффективной бактерицидной активностью против *M. tuberculosis* при экспериментальном туберкулёзе. Наряду с этим выявлено, что Рифизостреп не оказывает какого-либо побочного или отрицательного действия на организм в целом и на структуру внутренних органов подопытных телят. Проанализировано, что при применении препарата телята в течение длительного периода времени развиваются незначительные структурные изменения, выраженные в виде гемосидероза в клеточной структуре паренхиматозных органов и небольшого усиления секреции желудочно-кишечного тракта. По результатам патологоанатомических и лабораторных гистологических исследований установлено, что препарат является безвредным для организма животных и не оказывает общего и острого токсического действия.

Ключевые слова: микобактерии; туберкулёз; комбинация; препарат; Рифизостреп; доза; паренхиматозные органы; патологоанатомический; гистоморфологический; структура; гемосидероз; *in vivo*; аллергия; туберкулин

1. ВВЕДЕНИЕ

Introduction

Туберкулёз сельскохозяйственных животных и птиц, являясь значительной проблемой ветеринарной науки и практики, имеет также огромную степень социальной актуальности. Известно, что одной из причин уменьшения поголовья крупного рогатого скота является выделение положительно реагирующих на туберкулин животных при плановых аллергических исследованиях в животноводческих хозяйствах. Согласно действующим в нашей стране ветеринарным инструкциям и положениям, все положительно реагирующие животные подлежат немедленному изолированию от общего стада и отправке на санитарный убой. К тому же при таких исследованиях имеют место случаи выявления положительной реакции по другим причинам у животных, условно здоровых по туберкулёзу.

Подобные обстоятельства наносят серьёзные экономические потери животноводческому хозяйству. В связи с этим разработка мер борьбы и профилактики туберкулёза сельскохозяйственных животных остаётся, как и прежде, весьма востребованной.

2. МАТЕРИАЛЫ И МЕТОДЫ

Materials and methods

В целях разрешения данной проблемы в течение последних лет в лабораториях по изучению туберкулёза животных и патоморфологии Научно-исследовательского института ветеринарии сотрудниками проводятся широкомасштабные научно-практические работы исследовательского характера, в результате которых разработана новая комбинация противотуберкулёзных препаратов — Рифизостреп. С целью изучения эффективности данного нового комплекса против микобактерий в живом организме, то есть *in vivo* антибактериальной активности, а также влияния препарата на внутренние органы, был поставлен эксперимент на телятах чёрно-пёстрой породы 6–8-месячного возраста.

Перед началом опыта все телята были подвергнуты аллергическому исследованию, при котором положительная реакция на туберкулин через 72 часа после введения не была установлена. После этого всех телят заразили подкожно в области шеи суспензией *M. tuberculosis* в дозе 1 мл (0,03 мг/кг) и разделили на две группы по 3 головы. Первая группа была опытной,

вторая служила контролем. По истечении 24 дней после заражения, с учётом инкубационного периода развития микобактерий в организме животных, телятам первой опытной группы ввели препарат Рифизостреп в дозе 5,0 мл на 100 кг живой массы под кожу. Эту процедуру повторяли в течение 60 дней с десятидневными интервалами. Животным второй, контрольной группы препарат не применяли.

Общая длительность эксперимента составила 6 месяцев. По окончании опытов, при участии специально созданной комиссии, все телята были забиты в диагностических целях, вскрыты и подвергнуты тщательному патологоанатомическому исследованию. Затем от каждого подопытного животного был взят патологический материал — кусочки внутренних органов и лимфатических узлов толщиной 0,5–1 см — в 10-процентный раствор формалина с целью гистологических и микроскопических исследований.

3. РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЙ

Results

Патологоанатомическими исследованиями телят из первой опытной группы были установлены следующие показатели. Все телята средней упитанности. Общий вид, шерсть и кожа, видимые слизистые оболочки и наружные естественные отверстия — без видимых изменений. Под кожей шеи, на месте введения микобактерий, имеются несколько мелких (размером 2–5 мм) локальных инкапсулированных очажков, состоящих из остатков заражённого материала, общим диаметром 2–3 см.

В паренхиматозных органах грудной клетки и брюшной полости (лёгких, сердце, печени, почках и селезёнке), а также в желудочно-кишечном тракте телят первой опытной группы изменения патологического характера не были установлены. Однако у одного животного в лёгких, при отсутствии в органе изменений морфологической структуры, цвета, объёма и консистенции, в лобулярной части правой доли обнаружили участок размером 2,5–3 см, подвергшийся воспалению и выздоровлению. Кроме того, при визуальном осмотре и на разрезе большого количества лимфатических узлов организма подопытных телят — подчелюстных, заглоточных, трахеальных, бронхиальных, средостенных, портальных, мезентериальных, предлопаточных и паховых — развитие каких-либо патологических процессов также не было установлено.

Патологический материал, полученный из паренхиматозных органов и желудочно-кишечного тракта телят первой

опытной группы, после соответствующей гистологической обработки был подвергнут заливке парафином, из него изготовлены парафиновые блоки. Приготовленные на микротоме гистологические срезы были окрашены гематоксилин-эозином, а затем подвергнуты микроскопии.

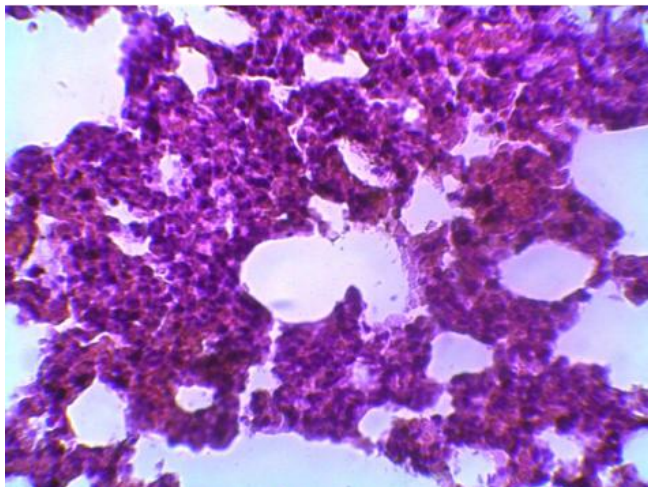


Рис. 1. Полнокровные сосуды межальвеолярных перегородок / **Fig. 1.** Hyperaemia of the vessels of the interalveolar septa

Внутренняя стенка альвеол лёгких состоит из однослойного плоского эпителия, между альвеолами расположены бронхи, полнокровные артерии и вены. Бронхи отличаются наличием слизистого, подслизистого, хрящевого и адвентициального слоёв. В мелких бронхах отсутствуют подслизистый и хрящевой слои. Однослойный реснитчатый эпителий слизистой основы в большинстве своём покрыт слизью.

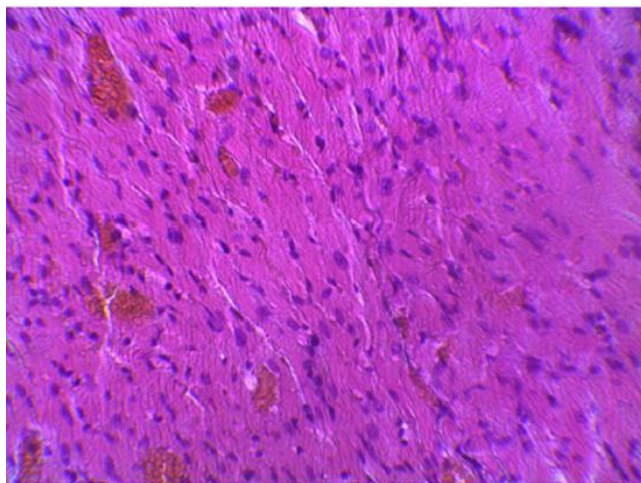


Рис. 2. Кровенаполненные сосуды сердечной мышцы / **Fig. 2.** Blood-filled vessels of the cardiac muscle

Микрокартина сердца представлена в виде мощного слоя поперечно-полосатых волокон и наполненных кровью сосудов; структура кардиомиоцитов выражена чётко, а их саркоплазма состоит из плотно расположенных миофибрилл.

Границы многочисленных печёночных долек выражены несколько слабо, вследствие чего их паренхиму можно определить по расположению центральных вен. Стенка вен состоит из однослойного эпителия и соединительнотканного покрова. Вокруг центральных вен расположены гемокапилляры и печёночные пластинки. В звёздчатых макрофагах внутри капилляров выступает тёмно-бурого цвета пигмент — гемосидерин в виде мелких зёрен или их скоплений. В структуре ядер многогранных гепатоцитов хорошо рассматривается мелкозернистый хроматин в виде пыли. Очень важен тот факт, что структура гепатоцитов в паренхиме и дольках печени однообразна и не подвержена изменениям дистрофического характера.

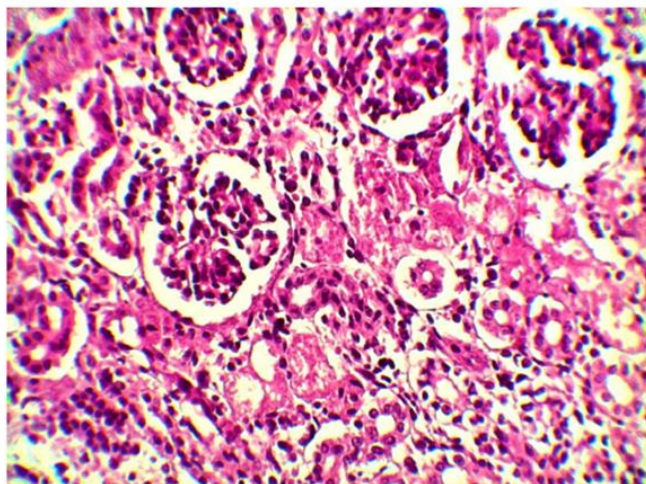


Рис. 3. Наличие зёрен липофусцина в нефроцитах почек / **Fig. 3.** Lipofuscin granules in the nephrocytes of the kidney

В гистологических препаратах из почек расположенная по периферии корковая часть органа, состоящая из почечных телец, проксимальных и дистальных отделов нефронов, без ярко выраженных границ плавно переходит в мозговую часть. Структура мозговой части, в свою очередь, образована петлями Генле и собирательными трубками. Почечные канальцы покрыты одним слоем высоких кубических клеток. В некоторых препаратах в дистальных частях нефроцитов просматриваются мелкие желтовато-бурого цвета зёрна липофусцина.

Большая часть паренхимы селезёнки состоит из белой пульпы, которая просматривается в виде круглых и овальных форм лимфоидных фолликулов, состоящих из скоплений многочисленных лимфоцитов. В красной пульпе расположены многочисленные расширенные кровеносные сосуды, состоящие в основном из венозных синусов. В просвете данных сосудов, наряду с форменными элементами крови, просматриваются также макрофаги, содержащие в своей цитоплазме зёрна, а местами и глыбки пигмента гемосидерина.

Слизистая оболочка желудка, представленная покровным эпителием, образована одним слоем цилиндрических клеток, сверху которых расположен мукоидный секрет розового цвета. В фундальной части желудка железы имеют вид трубок, в которых рассматривается покрывающий эпителий со слизистой массой.

Гистологические препараты, приготовленные из тонких кишок, представлены в виде многочисленных ворсинок и крипт под слизистой оболочкой. Поверхность пальцеобразных и в редких случаях листовидных ворсинок выражена в виде однослойного цилиндрического покровного эпителия. С окрашенной в розовый цвет цитоплазмой данные энтероциты имеют удлинённое ядро. В поле зрения препарата просматриваются также немногочисленные участки с явлениями отёка в тех местах, где волокна гладкомышечного слоя стенок кишок разрыхлены.

Слизистая оболочка стенок толстого отдела кишок с наличием многочисленных складок представлена в виде трубчатых крипт. Нечётко просматриваются ворсинки энтероцитов, покрывающих эти крипты. Также наблюдается собственная пластинка слизистой оболочки, состоящая из рыхлой волокнистой соединительной ткани, которая подвержена диффузии редких лимфоцитов и эпителиальных клеток. В складках слизистой расположены многочисленные кровеносные сосуды.

Ввиду того, что картина общего патологоанатомического вскрытия и гистологических исследований внутренних органов, в особенности многочисленных лимфатических узлов, у телят второй, контрольной группы была представлена в виде широко известных патологических процессов, характерных

для туберкулёзного поражения и освещённых многократно, повторное описание этих изменений здесь не приводится.

4. ОБСУЖДЕНИЕ

Discussion

С целью изучения действия на гистоморфологию внутренних органов новой комбинации противотуберкулёзных средств препарат Рифизостреп был применён телятам подкожно в дозе 5 мл на 100 кг живой массы в течение 60 дней с десятидневными интервалами. Анализ гистоморфологических исследований внутренних органов и лимфатических узлов подопытных животных показал, что при применении препарата в течение длительного периода времени развиваются незначительные структурные изменения в виде гемосидероза в паренхиматозных органах и небольшого усиления секреции желудочно-кишечного тракта.

По результатам патологоанатомических и лабораторных гистологических исследований установлено, что препарат Рифизостреп при длительном применении в дозе 5,0 мл на 100 кг живой массы является безвредным и не вызывает каких-либо поражений или морфологической деструкции внутренних органов телят. Исследованиями выявлено, что разработанный противотуберкулёзный комплексный препарат Рифизостреп безвреден для организма животных; в указанных дозах препарат не оказывает общего и острого токсического действия.

5. ЗАКЛЮЧЕНИЕ

Conclusion

На основании испытания препарата «Рифизостреп» против возбудителей микобактерий туберкулёза установлено, что препарат обладает достаточной бактериостатической и бактерицидной активностью. Препарат является экологически безвредным, не оказывает какого-либо отрицательного или побочного воздействия на организм животных в целом, проявляет синергизм и пролонгированный эффект, снижает отёчность и улучшает регенерацию тканей, обладает повышенным терапевтическим действием и может найти промышленное применение, имея фармакологическое преимущество перед известными препаратами-аналогами.

Установлено, что у заражённых микобактериями телят после применения препарата Рифизостреп туберкулёз в организме не развивается. В организме телят контрольной группы, заражённых возбудителями туберкулёза, но не получивших препарат, наблюдалось выраженное развитие типичного туберкулёза во внутренних органах и лимфатических узлах.

DECLARATIONS

Declarations

Author contributions CRedit

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

The experimental work on calves was carried out at the Scientific-Research Institute of Veterinary in accordance with the veterinary requirements and biosecurity rules in force in the Republic of Uzbekistan, under the supervision of a specially created commission. The study involved no human participants.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the Uzbek and English metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Tuberculosis of farm animals and birds is not only a significant problem of veterinary science and practice but also carries a considerable degree of social relevance. One of the reasons for the decrease in cattle numbers is the removal of animals that react positively to tuberculin during routine allergic testing on livestock farms: under the veterinary instructions and regulations in force in Uzbekistan, all positively reacting animals must be immediately isolated from the general herd and sent for sanitary slaughter. Moreover, such testing also produces positive reactions arising for other reasons in animals that are conditionally healthy with respect to tuberculosis. These circumstances inflict serious economic losses on livestock farming, and the development of control and preventive measures against tuberculosis of farm animals therefore remains as much in demand as before. To address this problem the staff of the Laboratory for the Study of Animal Tuberculosis and the Laboratory of Pathomorphology of the Scientific-Research Institute of Veterinary have carried out large-scale research over recent years, which resulted in a new combination of anti-tuberculosis drugs, Rifizostrep. The aim of the present work was to study in vivo the antibacterial activity of this new complex against mycobacteria in a living organism and, equally important, to establish by pathoanatomical and histomorphological examination whether prolonged administration of the preparation causes any damage to the internal organs of the treated animals.

Materials and methods

The experiment was conducted on calves of a black-and-white breed aged six to eight months. Before the start of the experiment all calves underwent an allergic test, and no positive reaction to tuberculin was established 72 hours after administration. All calves were then infected subcutaneously in the region of the neck with a suspension of *M. tuberculosis* at a dose of 1 ml (0.03 mg/kg) and divided into two groups of three head. The first group was the experimental group and the second served as the control. Twenty-four days after infection, taking into account the incubation period of mycobacterial development in the animal body, the calves of the first group were injected subcutaneously with Rifizostrep at a dose of 5.0 ml per 100 kg of live weight; the procedure was repeated over 60 days at ten-day intervals. The animals of the second, control group received no preparation. The total duration of the experiment was six months. At its conclusion, with the participation of a specially created commission, all calves were slaughtered for diagnostic purposes, dissected and examined pathoanatomically in detail. Pathological material — pieces of internal organs and lymph nodes 0.5–1 cm thick — was then taken from each animal and placed in ten per cent formalin solution. After the appropriate histological processing the material was embedded in paraffin, paraffin blocks were prepared, sections were cut on a microtome, stained with haematoxylin and eosin, and examined microscopically.

Results and discussion

Pathoanatomical examination of the calves of the first experimental group established the following. All the calves were of medium fatness; the general appearance, the coat and skin, the visible mucous membranes and the external natural orifices showed no visible changes. Under the skin of the neck, at the site where the mycobacteria had been introduced, there were several small encapsulated foci 2–5 mm in size, consisting of the remains of the infective material and occupying a total diameter of 2–3 cm. No changes of a pathological character were established in the parenchymal organs of the thoracic and abdominal cavities — the lungs, heart, liver, kidneys and spleen — nor in the gastrointestinal tract. In one animal, however, a site 2.5–3 cm in size that had undergone inflammation and subsequent recovery was found in the lobular part of the right lung lobe, while the morphological structure, colour, volume and consistency of the organ itself were unchanged. Visual inspection and sectioning of a large number of lymph nodes — submandibular, retropharyngeal, tracheal, bronchial, mediastinal, portal, mesenteric, prescapular and inguinal — likewise revealed no development of pathological processes. Histologically, the inner wall of the pulmonary alveoli consisted of a single layer of flat epithelium, with bronchi and blood-filled arteries and veins between the alveoli; hyperaemia of the vessels of the interalveolar septa was recorded. The heart appeared as a powerful layer of striated fibres with blood-filled vessels, the structure of the cardiomyocytes clearly expressed and their sarcoplasm composed of densely arranged myofibrils. In the liver the boundaries of the lobules were somewhat weakly expressed, so that the parenchyma could be identified by the position of the central veins; dark brown grains or clusters of haemosiderin appeared in the stellate macrophages within the capillaries, while the structure of the hepatocytes remained uniform and free of dystrophic change. In the kidneys the cortical part passed smoothly into the medulla without pronounced boundaries, the tubules were covered by a single layer of tall cubic cells, and small yellowish-brown grains of lipofuscin were visible in the distal parts of the nephrocytes in some preparations. Most of the splenic parenchyma consisted of white pulp in the form of round and oval lymphoid follicles, while numerous dilated venous sinuses in the red pulp contained macrophages with grains and, in places, clumps of haemosiderin in their cytoplasm. The gastric mucosa was covered by a single layer of cylindrical cells with a pink mucoid secretion above them, the fundal glands appearing as tubes. The small intestine showed numerous villi and crypts covered by a single-layered cylindrical epithelium, with a few areas of oedema where the fibres of the smooth muscle layer were loosened; the large intestine showed tubular crypts, a lamina propria of loose fibrous connective tissue infiltrated by scattered lymphocytes and epithelial cells, and numerous blood vessels in the folds of the mucosa. In the calves of the second, control group, which were infected but received no preparation, the picture of the general autopsy and of the histological examination of the internal organs and especially of the numerous lymph nodes corresponded to the well-known pathological processes characteristic of tuberculous lesions.

Conclusion and contribution

Testing of Rifizostrep against the causative agents of mycobacterial tuberculosis established that the preparation possesses sufficient bacteriostatic and bactericidal activity. It is ecologically harmless, exerts no negative or side effect on the animal organism as a whole, shows synergism and a prolonged effect, reduces oedema and improves tissue regeneration, has an enhanced therapeutic action and may find industrial application, having a pharmacological advantage over the known analogous preparations. Analysis of the histomorphological studies of the internal organs and lymph nodes of the experimental animals showed that prolonged administration produces only minor structural changes, expressed as haemosiderosis in the parenchymal organs and a slight increase in the secretion of the gastrointestinal tract. On the basis of the pathoanatomical and laboratory histological investigations it was established that Rifizostrep, administered over a long period at a dose of 5.0 ml per 100 kg of live weight, is harmless and causes no damage or morphological destruction of the internal organs of calves; in the doses indicated it exerts no general or acute toxic effect. Tuberculosis did not develop in the infected calves that received the preparation, whereas the internal organs and lymph nodes of the untreated control calves showed pronounced typical tuberculous lesions. The contribution of this work lies in providing the histomorphological safety evidence that a candidate anti-tuberculosis combination requires before it can move toward practical veterinary use.

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Radiological monitoring of environmental objects on farms in the Bekabad district of the Tashkent region

Toshkent viloyati Bekobod tumanidagi fermer xo'jaliklarida atrof-muhit obyektlarining radiologik monitoringi

Радиологический мониторинг объектов окружающей среды в фермерских хозяйствах Бекабадского района Ташкентской области

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Abstract. This article presents the results of radiometric and radiation-hygienic investigations conducted on dairy farms located in the Turon area of the Bekabad district, Tashkent region. The study analyses the local radiation background, including ambient gamma dose rates and radionuclide concentrations in soil, livestock feed supplies and dairy products (milk). Based on the empirical data collected, scientifically grounded conclusions and practical recommendations are provided to evaluate environmental safety and ensure the radiological purity of livestock products in the region. Detailed information is given on the laboratory testing of soil, alfalfa, water bodies and hay samples on the farm.

Keywords: radioactivity; dosimetry; ionizing radiation; ambient gamma background; radioactive fallout; radioactive isotopes; neutron; muffle furnace; feed; nuclear reactions; radioecological monitoring

O'ZBEKCHA

XAKIMOV B.N.¹, HOJIQULOV H.N.¹, AYUPOVA J.R.¹¹ Veterinariya ilmiy-tadqiqot instituti, O'zbekiston

Annotatsiya. Ushbu maqolada Toshkent viloyatining Bekobod tumani «Turon» hududida joylashgan sut yo'nalishidagi fermer xo'jaliklarida o'tkazilgan radiometrik va radiatsion-gigiyenik tadqiqotlar natijalari yoritilgan. Tadqiqot davomida ushbu xo'jaliklardagi radiatsiyaviy muhit holati, jumladan tuproq, ozuqa bazasi hamda chorva mahsulotlari (sut) tarkibidagi radionuklidlar miqdori va gamma-nurlanish dozasining quvvati tahlil qilingan. Olingan ma'lumotlar asosida chorvachilik mahsulotlarining ekologik va radiatsion xavfsizligini ta'minlash hamda hududdagi radiatsion fonni baholashga qaratilgan ilmiy asoslangan xulosalar va amaliy tavsiyalar ishlab chiqilgan. Xo'jalik hududidagi tuproq, beda, suv havzalari va pichan namunalari laboratoriya sharoitida tekshirilgani haqida batafsil ma'lumotlar berilgan.

Kalit so'zlar: radioaktivlik; dozimetriya; ionlashtiruvchi nurlanish; tashqi gamma-fon; radioaktiv tushish; radioaktiv izotoplar; neytron; mufel pechi; yem-xashak; yadro reaksiyalari; radioekologik monitoring

РУССКИЙ

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Аннотация. В данной статье представлены результаты радиометрических и радиационно-гигиенических исследований, проведённых в молочных фермерских хозяйствах территории «Турон» Бекабадского района Ташкентской области. В ходе исследования проанализировано состояние радиационного фона, включая мощность дозы гамма-излучения, а также содержание радионуклидов в почве, кормовой базе и животноводческой продукции (молоке). На основе полученных данных сформулированы научно обоснованные выводы и практические рекомендации, направленные на оценку экологической безопасности и обеспечение радиационной чистоты производимой молочной продукции в данном регионе. Представлена подробная информация о лабораторных исследованиях образцов почвы, люцерны, водоёмов и сена в хозяйстве.

Ключевые слова: радиоактивность; дозиметрия; ионизирующее излучение; внешний гамма-фон; радиоактивные выпадения; радиоактивные изотопы; нейтрон; муфельная печь; корм; ядерные реакции; радиоэкологический мониторинг

1. KIRISH

Introduction

Yer yuzidagi barcha tirik organizmlar doimo ionlashtiruvchi nurlanish ta'sirida bo'ladi. Ionlashtiruvchi nurlanish manbalarini kelib chiqishiga ko'ra uch guruhga bo'lish mumkin. Birinchi guruhga kosmik kelib chiqishga ega nurlanishlar kiradi. Ikkinchi guruhni yer jinslarining tabiiy radioaktiv moddalari hamda tuproq, suv, havo, o'simlik va hayvonot dunyosida, shuningdek inson tanasida mavjud bo'lgan tabiiy radioaktiv elementlarning nurlanishi tashkil etadi. Ushbu ikki guruh ionlashtiruvchi nurlanishning tabiiy fonini yuzaga keltiradi.

Uchinchi guruhga sun'iy radionuklidlar kiradi. Ular yadroviy qurol sinovlari yoki atom elektr stansiyalaridagi avariya (Chernobil, Fukushima va boshqalar) natijasida hosil bo'lib, mahalliy, troposfera yoki global yog'inlar shaklida yer yuzasiga tushadi yoxud radioaktiv sanoat korxonalarini demontaj qilish jarayonida tashqi muhitga chiqadi. Bu manbalarining barchasi ma'lum sharoitlarda ichki va tashqi nurlanish orqali hayvonlar va odamlar organizmiga sezilarli ta'sir ko'rsatishi mumkin. Tashqi va ichki manbalarining yig'indisi radiatsion fonni belgilaydi.

Elementlarning tabiiy aralashmasida mavjud bo'lgan tabiiy radioaktiv izotoplardan tashqari, turli yadroviy reaksiyalarning natijasida — yadro reaktorlarida barqaror kimyoviy elementlarning neytron oqimlari bilan nurlantirilishi yoki og'ir zarralar bilan bombardimon qilinishi orqali — olingan ko'plab sun'iy izotoplar ham ma'lum. Yadro sinovlaridan keyingi dastlabki oylarda yoki avariya natijasida parchalanish bo'laklari aralashmasi ^{131}I , ^{140}Ba va ^{90}Sr ni, keyinchalik esa asosan ^{90}Sr va ^{137}Cs ni o'z ichiga oladi; ular atrof-muhitning global radioaktiv ifloslanishining asosiy qismini tashkil qiladi.

O'z-o'zidan (quruq yog'ingarchilik) yoki ko'pincha atmosfera yog'inlari bilan birga tushadigan yadroviy parchalanishning radioaktiv mahsulotlari biosferaning abiotik (suv, tuproq) va biotik (o'simlik, hayvonot dunyosi) tarkibiga kiradi hamda moddalarning biologik aylanishiga qo'shiladi. Bunday holda parchalanish mahsulotlari inson organizmiga o'simlik oziq-ovqatlari orqali yoki radioaktiv moddalarni o'z ichiga olgan yem-xashakni iste'mol qilgan hayvonlar mahsulotlari orqali kirib boradi.

2. RADIOEKOLOGIK MONITORINGNING MAQSADI VA VAZIFALARI

Aims and objectives of radioecological monitoring

Radioekologik monitoring — atrof-muhit komponentlarida (atmosfera havosi, tuproq, yer usti va yer osti suvlari, o'simlik va hayvonot dunyosi) tabiiy hamda texnogen radionuklidlarning tarqalishini, ularning migratsiyasi va biologik aylanishini muntazam kuzatish, baholash hamda prognozlashga qaratilgan kompleks ilmiy-amaliy tadbirlar tizimidir. Monitoring natijalari aholi salomatligini muhofaza qilish, qishloq xo'jaligi mahsulotlari xavfsizligini ta'minlash va ekologik barqarorlikni saqlashda muhim ilmiy asos bo'lib xizmat qiladi.

Radioekologik monitoringning asosiy maqsadi radiatsiyaviy xavf tug'dirishi mumkin bo'lgan tabiiy va texnogen manbalar ta'sirida atrof-muhitda yuz berayotgan radiatsion o'zgarishlarni o'z vaqtida aniqlash, ularning ekologik va sanitariya-gigiyenik oqibatlarini baholash hamda inson salomatligi va biosfera uchun xavfsiz sharoitni ta'minlashdan iborat. Ayniqsa atom energetikasi obyektlari, metallurgiya korxonalari, konchilik sanoati, radioaktiv materiallardan foydalanuvchi ishlab chiqarish tarmoqlari hamda radioaktiv chiqindilar saqlanadigan hududlarda bunday monitoringning ahamiyati yanada ortadi.

Toshkent viloyatining Bekobod tumani va Bekobod shahri respublikaning yirik sanoat hududlaridan biri bo'lib, metallurgiya, qurilish materiallari ishlab chiqarish hamda yangi metallurgiya quvvatlarining rivojlanishi bilan tavsiflanadi. Hududda qora metallurgiya sanoatining rivojlanganligi va to'g'ridan-to'g'ri tiklangan temir ishlab chiqarish loyihalarining amalga oshirilishi atmosfera, tuproq va suv obyektlarining ekologik holatini, jumladan radiatsion fon ko'rsatkichlarini muntazam nazorat qilish zaruratini yuzaga keltiradi. Bunda radioekologik monitoring sanoat faoliyatini radiatsion xavfsizlik nuqtai nazaridan baholash uchun muhim ilmiy vosita hisoblanadi.



1-rasm. Radioekologik monitoringning maqsadi / Fig. 1. Aims of radioecological monitoring

Bekobod tumani sharoitida radioekologik monitoringning asosiy vazifalari quyidagilardan iborat: atmosfera havosidagi tashqi gamma-fon dozasi quvvatini muntazam o'lchash; tuproq namunalari tarkibidagi tabiiy radionuklidlar (^{238}U , ^{232}Th , ^{40}K) hamda zarur hollarda sun'iy radionuklidlar (^{137}Cs , ^{90}Sr) miqdorini aniqlash; Sirdaryo suvi, sug'orish suvlari va yer osti suvlari tarkibidagi radiologik ko'rsatkichlarni baholash; qishloq xo'jaligi ekinlari, yem-xashak, sut, go'sht va baliq mahsulotlarida radionuklidlarning biokkumulyatsiya darajasini aniqlash; sanoat korxonalari yaqinidagi kuzatuv nuqtalarida radiatsion foning vaqt bo'yicha dinamikasini o'rganish; radiatsion ko'rsatkichlarning sanitariya me'yorlari va

xalqaro tavsiyalarga mosligini baholash; radiatsion xavf tug'ilishi mumkin bo'lgan holatlarni erta aniqlash va ularning oldini olish bo'yicha tavsiyalar ishlab chiqish.

Radioekologik monitoringda olingan natijalar faqat radiatsiya darajasini aniqlash bilan cheklanmaydi. Ular radionuklidlarning migratsiya qonuniyatlarini, oziq zanjiri orqali tirik organizmlarga o'tishini, bioakkumulyatsiya va biomagnifikatsiya jarayonlarini o'rganish imkonini beradi. Shu sababli monitoring natijalari ekologik xavfni baholash, qishloq xo'jaligi mahsulotlarining radiatsion xavfsizligini ta'minlash hamda hududning ekologik pasportini shakllantirishda muhim ilmiy asos hisoblanadi.

Bekobod tumani misolida radioekologik monitoringni tashkil etishda kuzatuv punktlarini sanoat korxonalari, avtomobil yo'llari, aholi yashash punktlari, sug'oriladigan qishloq xo'jaligi maydonlari hamda Sirdaryo bo'ylarida joylashtirish maqsadga muvofiqdir. Har bir kuzatuv nuqtasida gamma-fon doza quvvati ($\mu\text{Sv}/\text{soat}$), tuproqning solishtirma faolligi (Bq/kg), suvning umumiy alfa va beta faolligi (Bq/l), shuningdek qishloq xo'jaligi mahsulotlaridagi radionuklidlar miqdori aniqlanadi. Ushbu ma'lumotlar geografik axborot tizimlari va statistik tahlil usullari yordamida qayta ishlanib, hududning radioekologik xaritalari tuziladi. Bu esa radiatsion xavf zonalarini aniqlash, ekologik prognozlar tuzish hamda hududning barqaror rivojlanish strategiyasini ishlab chiqishda muhim ahamiyat kasb etadi.

3. XULOSA

Conclusion

Toshkent viloyati Bekobod tumani sharoitida radioekologik monitoringni muntazam tashkil etish sanoatlashgan hududlarda radiatsion xavfsizlikni ta'minlash, ekologik muvozanatni saqlash, oziq-ovqat xavfsizligini mustahkamlash hamda aholi salomatligini muhofaza qilishning muhim ilmiy-amaliy omillaridan biri hisoblanadi. Monitoring natijalari hududning ekologik holatini kompleks baholash, radiatsion xavf darajasini prognozlash va ekologik boshqaruv qarorlarini ilmiy asoslash imkonini beradi.

DECLARATIONS

Declarations

Author contributions CRedit

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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This research received no external funding.

Ethics approval

The work was carried out as part of routine radiometric and radiation-hygienic monitoring on farms in accordance with the requirements in force in the Republic of Uzbekistan. It involved no experiments on animals and no human participants.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

All living organisms on Earth are continuously exposed to ionizing radiation. Its sources fall into three groups: cosmic radiation; the natural radioactive substances of the Earth's crust and the natural radionuclides present in soil, water, air, plants, animals and the human body; and artificial radionuclides formed by nuclear weapon tests or accidents at nuclear power plants such as Chernobyl and Fukushima, which reach the Earth's surface as local, tropospheric or global fallout, or enter the environment during the decommissioning of radioactive industrial facilities. The first two groups create the natural radiation background, and the sum of external and internal sources determines the total background. Radioactive products of nuclear fission enter the abiotic components of the biosphere — water and soil — and its biotic components, and then the biological cycle of matter, so that fission products reach the human body through plant foods or through the products of animals that have consumed contaminated feed. The Bekabad district and the town of Bekabad in the Tashkent region form one of the largest industrial areas of the republic, characterized by metallurgy, the production of building materials and the development of new metallurgical capacity, including direct reduced iron projects. This makes regular monitoring of the ecological state of the atmosphere, soil and water bodies — and of radiation background indicators in particular — a necessity. The purpose of this article is to set out the aims, objectives and organizational principles of radioecological monitoring for the conditions of the Bekabad district and to present the results of radiometric and radiation-hygienic investigations carried out on dairy farms of the Turan area.

Materials and methods

The work is based on the analysis of published sources on radioecological monitoring, practical dosimetry and veterinary radiobiology, and on radiometric and radiation-hygienic investigations carried out on dairy farms in the Turan area of the Bekabad district. The monitoring programme covered the ambient gamma dose rate in the atmosphere, the content of natural radionuclides — uranium-238, thorium-232 and potassium-40 — in soil samples and, where required, of artificial radionuclides such as caesium-137 and strontium-90; the radiological indicators of the water of the Syr Darya, of irrigation water and of groundwater; the degree of bioaccumulation of radionuclides in agricultural crops, feed, milk, meat and fish products; and the dynamics of the radiation background over time at observation points near industrial enterprises. Samples of soil, alfalfa, hay and water taken on the farms were examined under laboratory conditions. At each observation point the gamma dose rate is measured in microsieverts per hour, the specific activity of the soil in becquerels per kilogram and the total alpha and beta activity of water in becquerels per litre. Observation points are placed with regard to the location of industrial enterprises, motor roads, settlements, irrigated agricultural land and the banks of the Syr Darya; the data are processed by means of geographic information systems and statistical methods so that radioecological maps of the territory can be compiled.

Results and discussion

Radioecological monitoring is a system of complex scientific and practical measures aimed at the regular observation, assessment and forecasting of the distribution, migration and biological circulation of natural and technogenic radionuclides in the components of the environment. Its results serve as an important scientific basis for protecting public health, ensuring the safety of agricultural products and maintaining ecological stability. The principal aim of such monitoring is the timely detection of radiation changes occurring in the environment under the influence of natural and technogenic sources that may present a radiation hazard, the assessment of their ecological and sanitary-hygienic consequences, and the provision of safe conditions for

human health and for the biosphere. The importance of monitoring increases further in the vicinity of nuclear power facilities, metallurgical enterprises, the mining industry, production sectors using radioactive materials and areas where radioactive waste is stored. For the conditions of the Bekabad district the main tasks were defined as regular measurement of the ambient gamma dose rate; determination of natural and, where necessary, artificial radionuclides in soil; assessment of radiological indicators in the Syr Darya, irrigation water and groundwater; determination of the bioaccumulation of radionuclides in crops, feed, milk, meat and fish; study of the temporal dynamics of the background near industrial enterprises; assessment of the compliance of radiation indicators with sanitary norms and international recommendations; and early detection of situations that may give rise to radiation hazard, together with the development of preventive recommendations. The results of monitoring are not limited to establishing radiation levels: they make it possible to study the migration patterns of radionuclides, their transfer to living organisms through the food chain, and the processes of bioaccumulation and biomagnification. They therefore constitute an important scientific basis for assessing ecological risk, ensuring the radiation safety of agricultural products and compiling an ecological passport of the territory.

Conclusion and contribution

Regular organization of radioecological monitoring in the conditions of the Bekabad district of the Tashkent region is one of the important scientific and practical factors in ensuring radiation safety in industrialized areas, maintaining ecological balance, strengthening food safety and protecting public health. The results of monitoring make it possible to assess the ecological state of the territory comprehensively, to forecast the level of radiation risk and to place ecological management decisions on a scientific footing. The contribution of this work lies in setting out, for a specific industrial district of Uzbekistan, a structured programme of radioecological monitoring covering the atmosphere, soil, water, feed and livestock products, and in linking that programme to the practical requirement of guaranteeing the radiological purity of dairy production.

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Monitoring the radioecological state of the agroecosystem of the Navbahor area, Bekabad district, Tashkent region (a case study of the Khoji-Ahmad farm)

Toshkent viloyati Bekobod tumani Navbahor hududidagi agroekotizimning radioekologik holatini monitoring qilish («Xoji-Ahmad» fermer xo'jaligi misolida)

Мониторинг радиоэкологического состояния агроэкосистемы территории Навбахор Бекабадского района Ташкентской области (на примере фермерского хозяйства «Ходжи-Ахмад»)

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ENGLISH

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Abstract. This article presents the results of radiometric studies conducted at the Khoji-Ahmad dairy farm located in the Navbahor area of the Bekabad district, Tashkent region. To assess the radiological status of the farm comprehensively, laboratory analysis was performed on samples of soil, water bodies and livestock feed supplies, specifically alfalfa and hay. On the basis of the empirical laboratory data the local radiation background was evaluated, and evidence-based conclusions and practical recommendations were developed to ensure the ecological safety and radiological purity of dairy products in the region.

Keywords: radiometric studies; Bekabad district; dairy farm; radiation-hygienic assessment; radioactive isotopes; ambient gamma background; ionizing radiation; livestock feed; soil and water samples; environmental safety; caesium-137

O'ZBEKCHA

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Annotatsiya. Ushbu maqolada Toshkent viloyati Bekobod tumanining «Navbahor» hududida joylashgan «Xoji-Ahmad» sut yo'nalishidagi fermer xo'jaligida o'tkazilgan radiometrik tadqiqotlar natijalari yoritilgan. Tadqiqot vaqtidagi radiatsion-gigiyenik holatni har tomonlama baholash maqsadida xo'jalik hududidagi tuproq, suv havzalari, shuningdek chorva ozuqasi hisoblangan beda va pichan namunalarida radiatsiyaviy ko'rsatkichlar va radionuklidlar miqdori laboratoriya sharoitida atroflicha tahlil qilingan. Olingan tahlil natijalari asosida hududning radiatsion foni holatiga baho berilgan hamda sut yo'nalishidagi chorvachilik mahsulotlarining ekologik xavfsizligi va radiatsion tozaligini ta'minlash bo'yicha ilmiy xulosalar va amaliy tavsiyalar ishlab chiqilgan.

Kalit so'zlar: radiometrik tadqiqotlar; Bekobod tumani; sut yo'nalishidagi fermer xo'jaligi; radiatsion-gigiyenik baholash; radioaktiv izotoplar; tashqi gamma-fon; ionlashtiruvchi nurlanish; ozuqa bazasi; tuproq va suv namunalari; ekologik xavfsizlik; seziy-137

РУССКИЙ

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HAC / OAK: On the HAC list of national scientific publications (Academy of Sciences of the Republic of Uzbekistan) for 06.00.00 Agricultural Sciences and 16.00.00 Veterinary Sciences. O'zbekiston Respublikasi FA huzuridagi OAK ro'yxatida: 06.00.00 – Qishloq xo'jaligi fanlari; 16.00.00 – Veterinariya fanlari.

Аннотация. В данной статье представлены результаты радиометрических исследований, проведённых в молочном фермерском хозяйстве «Ходжи-Ахмад», расположенном на территории «Навбахор» Бекабадского района Ташкентской области. Для комплексной оценки радиационно-гигиенической обстановки в лабораторных условиях был проведён детальный анализ образцов почвы, водоёмов, а также кормовых культур (люцерны и сена), отобранных на территории хозяйства. На основе полученных экспериментальных данных дана оценка уровню естественного радиационного фона и разработан научно обоснованный комплекс выводов и рекомендаций, направленных на обеспечение экологической и радиационной безопасности животноводческой продукции.

Ключевые слова: радиометрические исследования; Бекабадский район; молочное фермерское хозяйство; радиационно-гигиеническая оценка; радиоактивные изотопы; внешний гамма-фон; ионизирующее излучение; кормовая база; образцы почвы и воды; экологическая безопасность; цезий-137

1. KIRISH

Introduction

Yer yuzidagi barcha tirik organizmlar hayoti davomida doimiy ravishda ionlashtiruvchi nurlanish ta'sirida bo'ladi. Ionlashtiruvchi nurlanish manbalari kelib chiqishiga ko'ra uch asosiy guruhga ajratiladi.

Birinchi guruhni kosmik nurlanish tashkil etadi. Ushbu nurlanish Quyosh va boshqa kosmik jismlardan kelib chiqadigan yuqori energiyali zarrachalar oqimi bo'lib, atmosfera orqali Yer yuzasiga yetib keladi. Kosmik nurlanishning intensivligi dengiz sathidan balandlik, geografik kenglik hamda atmosferaning fizik holatiga bog'liq holda o'zgarib turadi.

Ikkinchi guruh tabiiy radioaktiv manbalardan iborat bo'lib, ularga Yer qobig'idagi tog' jinslari, tuproq, suv, atmosfera havosi, o'simlik va hayvonot dunyosi, shuningdek inson organizmida tabiiy ravishda uchraydigan radionuklidlar (^{238}U , ^{232}Th , ^{40}K va boshqalar) kiradi. Mazkur radionuklidlarning tabiiy parchalanishi natijasida hosil bo'ladigan ionlashtiruvchi nurlanish kosmik nurlanish bilan birgalikda tabiiy radiatsion fonni shakllantiradi. Tabiiy radiatsion fon biosferaning ajralmas tarkibiy qismi bo'lib, barcha tirik organizmlar evolyutsiyasi davomida ushbu omil ta'siri ostida rivojlangan.

Uchinchi guruh sun'iy radionuklidlardan iborat bo'lib, ular asosan yadroviy qurol sinovlari, atom energetikasi obyektlaridagi avariya va radioaktiv materiallardan foydalanuvchi sanoat korxonalari faoliyati natijasida atrof-muhitga tushadi.

2. MATERIALLAR VA METODLAR

Materials and methods

Kuzatuv punktlarini tanlashda quyidagi mezonlarga alohida e'tibor qaratildi: radiatsion xavf tug'dirishi mumkin bo'lgan sanoat obyektlarining joylashuvi; shamol yo'nalishi va atmosfera massalarining harakatlanish xususiyatlari; mavjud yoki ehtimoliy radioak-

tiv ifloslanishning tarqalish yo'nalishi; yer resurslaridan foydalanish tarkibi va agroekotizimning funksional tuzilishi; tuproq qoplam turlari va ularning fizik-kimyoviy xususiyatlari; chorva mollari yaylovlari hamda yem-xashak ekinlari joylashgan maydonlar; sug'orish tarmoqlari va suv manbalarining hududiy joylashuvi.

Tadqiqot davomida hududning tashqi gamma-fon doza quvvati radiometrik asboblardan yordamida o'lchandi. Olingan natijalar radiatsion monitoring bo'yicha amaldagi me'yoriy hujjatlar talablari asosida baholandi. Kuzatuv natijalari statistik usullar yordamida qayta ishlanib, hududning radioekologik holati kompleks tahlil qilindi. Monitoring ma'lumotlari asosida tadqiqot hududining radiatsion xavfsizlik darajasi baholandi hamda agroekotizimning ekologik barqarorligini ta'minlashga qaratilgan ilmiy-amaliy tavsiyalar ishlab chiqildi.

3. TADQIQOT NATIJALARI VA ULARNING TAHLILI

Results and discussion

Radioekologik monitoring doirasida tadqiqot obyekti sifatida Toshkent viloyati Bekobod tumani Navbahor hududida joylashgan «Xoji-Ahmad» fermer xo'jaligi tanlandi. Monitoring ishlari Veterinariya ilmiy-tadqiqot instituti Biokimyo va radiobiologiya laboratoriyasi mutaxassislari tomonidan fermer xo'jaligi veterinariya shifokori ishtirokida amalga oshirildi.

Monitoring dasturiga muvofiq radiatsion nazorat obyektlari sifatida qishloq xo'jaligi yerlari, yem-xashak ekinlari, chorvachilik binolari, yem omborlari, suv manbalari hamda chorva mollari boqiladigan yaylovlar tanlandi. Tadqiqot davomida tashqi gamma-fon doza quvvati dala sharoitida portativ dozimetrlar yordamida aniqlandi. O'lchovlar shamolsiz va bulutsiz ob-havo sharoitida, havo harorati 28°C bo'lgan vaqtda, yer yuzasidan 5–8 sm hamda 1 m balandliklarda bajarildi. Kuzatuv punktlari agroekotizimning relyefi, shamol yo'nalishi va yerlardan foydalanish xususiyatlari hisobga olingan holda tanlandi.

1-jadval

Monitoring natijalari / Table 1. Monitoring results

Kuzatuv obyekti	Gamma-fon doza quvvati ($\mu\text{R}/\text{soat}$)
Beda maydoni (10 nuqta bo'yicha o'rtacha)	14,5
Ferma hovlisi	13,8
Dezobaryer oldi	11,8
Tug'ruqxona	9,6
Boqish bo'limi	12,1
Yem saqlash ombori	13,1
Suv havzasi	12,5
Nazorat uchastkasi (100 × 100 m)	11,3

Barcha o'lchovlar bir xil ob-havo sharoitida, yer yuzasidan 5–8 sm va 1 m balandliklarda bajarilgan.

Olingan natijalar tadqiqot hududida tashqi gamma-fonning tabiiy radiatsion fon chegarasida ekanligini ko'rsatdi. Kuzatuv nuqtalari bo'yicha qayd etilgan ko'rsatkichlar o'rtasidagi tafovutlar hudud relyefi, tuproqning fizik xususiyatlari va tabiiy radionuklidlarning notekis taqsimlanishi bilan izohlanadi.

Monitoring davomida laboratoriya tahlillari uchun 1 kg tuproq, 1 kg yem-xashak va 1,5 litr suv namunalari olindi. Suv namunalari oldindan xlorid kislotasining suyultirilgan eritmasi bilan ishlov berilgan plastik idishlarga yig'ildi; ushbu usul radionuklidlarning idish devorlariga adsorbsiyalanishining oldini olish imkonini berdi. Laboratoriyada suv namunalari 100–150 ml hajm ajratilib, 100–105 °C haroratda bug'latildi va hosil bo'lgan qoldiq radiometrik tahlil qilindi.



1-rasm. Radioekologik monitoring natijalari / **Fig. 1.** Results of the radioecological monitoring

O'simlik namunalari tanlashda «konvert» usuli qo'llanildi: har bir maydondan beshta nuqtada namuna olinib, o'rtacha aralash namuna shakllantirildi. Bundan tashqari, chorva mollari iste'mol qiladigan yaylovlardan yashil massa, yem omboridan bug'doy va somon namunalari olindi.

Laboratoriya tahlili uchun yashil massa namunalari dastlab 90–120 °C haroratda doimiy massagacha quritildi. So'ngra namunalar 200 °C da karbonizatsiya qilinib, keyinchalik 400–500 °C haroratda mufel pechida to'liq kul holatiga keltirildi. Hosil qilingan kul namunalari radioaktiv sezgi (¹³⁷Cs) miqdori B.P. Kruglikov tomonidan tavsiya etilgan radiokimyoviy usul asosida aniqlandi. Ushbu metod sezgiyini geksaxlorotellurit birikmasi ko'rinishida ajratib olish va keyinchalik spektrometrik tahlil qilishga asoslanadi.

Laboratoriya tekshiruvlari natijasida beda, somon va bug'doy namunalari ¹³⁷Cs radionuklidi aniqlanmadi. Shuningdek, tuproq va suv namunalari ham radiatsion ko'rsatkichlar amaldagi radiatsion xavfsizlik me'yorlaridan oshmaganligi qayd etildi. Olingan natijalar fermer xo'jaligi agroekotizimida radiatsion fonning tabiiy darajada ekanligini hamda texnogen radionuklidlar bilan ifloslanish kuzatilmaganligini ko'rsatdi.

4. XULOSALAR

Conclusions

- Tadqiqot hududidagi tashqi gamma-fon doza quvvati 9,6–14,5 µR/soat oralig'ida bo'lib, tabiiy radiatsion fon chegarasidan oshmaydi.
- Tuproq, suv, yem-xashak va o'simlik namunalari radiatsion ko'rsatkichlar amaldagi radiatsion xavfsizlik me'yorlariga mos ekanligi aniqlandi.
- Beda, somon va bug'doy namunalari radiokimyoviy tahlillar natijasida ¹³⁷Cs radionuklidi aniqlanmadi; bu qishloq xo'jaligi mahsulotlarining radiatsion jihatdan xavfsizligini tasdiqlaydi.
- Fermer xo'jaligi hududida texnogen radiatsion ifloslanish belgilari kuzatilmadi va agroekotizimning radioekologik holati barqaror deb baholandi.

5. Olingan natijalar hududda yetishtirilayotgan yem-xashak va chorvachilik mahsulotlari radiatsion xavfsizlik talablariga javob berishini hamda inson salomatligi va hayvonlar uchun radiatsion xavf mavjud emasligini ko'rsatdi.

Shu bilan birga, radiatsion vaziyatni uzoq muddatli nazorat qilish maqsadida qishloq xo'jaligi yerlari, suv manbalari va yem-xashak mahsulotlarida radioekologik monitoringni muntazam ravishda davom ettirish tavsiya etiladi.

DECLARATIONS

Declarations

Author contributions CRediT

Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

The work consisted of radiometric measurements and laboratory analysis of soil, water and feed samples carried out in accordance with the requirements in force in the Republic of Uzbekistan. It involved no experiments on animals and no human participants.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

All living organisms are continuously exposed to ionizing radiation throughout their lives, and the sources of that radiation fall into three main groups: cosmic radiation, whose intensity varies with altitude above sea level, geographical latitude and the physical state of the atmosphere; natural radioactive sources, comprising the rocks of the Earth's crust, soil, water, atmospheric air, plants, animals and the radionuclides occurring naturally in the human body, such as uranium-238, thorium-232 and potassium-40, whose decay together with cosmic radiation forms the natural radiation background; and artificial radionuclides, which enter the environment mainly as a result of nuclear weapon tests, accidents at nuclear power facilities and the activity of industrial enterprises using radioactive materials. The Bekabad district of the Tashkent region is one of the largest industrial areas of the republic, and the presence of ferrous metallurgy there makes it necessary to establish whether livestock production in the surrounding agroecosystems remains radiologically clean. The purpose of this study was to assess the radioecological state of the agroecosystem of the Navbahor

area of the Bekabad district, using the Khoji-Ahmad dairy farm as a case study, to measure the ambient gamma dose rate at the principal points of the farm, to determine the radionuclide content of soil, water and feed, and on that basis to develop practical recommendations for ensuring the ecological safety and radiological purity of dairy products.

Materials and methods

The monitoring was carried out by specialists of the Laboratory of Biochemistry and Radiobiology of the Scientific-Research Institute of Veterinary together with the veterinarian of the farm. Observation points were selected with regard to the location of industrial facilities that might present a radiation hazard, the prevailing wind direction and the movement of air masses, the likely direction of spread of existing or potential radioactive contamination, the pattern of land use and the functional structure of the agroecosystem, the types of soil cover and their physical and chemical properties, the location of pastures and fodder crops, and the layout of irrigation networks and water sources. The objects of radiation control were agricultural land, fodder crops, livestock buildings, feed stores, water sources and grazing pastures. The ambient gamma dose rate was determined in the field with a portable dosimeter; measurements were made in windless, cloudless weather at an air temperature of 28 °C, at heights of 5–8 cm and 1 m above the ground surface. For laboratory analysis 1 kg of soil, 1 kg of feed and 1.5 litres of water were collected. Water samples were collected in plastic containers pre-treated with dilute hydrochloric acid to prevent adsorption of radionuclides onto the container walls; in the laboratory 100–150 ml aliquots were evaporated at 100–105 °C and the residue analysed radiometrically. Plant samples were taken by the envelope method, five points per field being combined into one average sample; green mass was taken from the pastures and wheat and straw from the feed store. For analysis the green mass was first dried at 90–120 °C to constant mass, then carbonized at 200 °C and finally ashed completely in a muffle furnace at 400–500 °C. Caesium-137 in the ash was determined by the radiochemical method recommended by B.P. Kruglikov, based on the separation of caesium as a hexachlorotellurite compound followed by spectrometric analysis. The results were processed statistically and evaluated against the requirements of the normative documents in force for radiation monitoring.

Results and discussion

The ambient gamma dose rate recorded at the eight observation points of the farm ranged from 9.6 to 14.5 µR/h. The highest value, 14.5 µR/h, was obtained as the mean of ten points in the alfalfa field, followed by the farmyard at 13.8 µR/h, the feed store at 13.1 µR/h, the water reservoir at 12.5 µR/h, the feeding station at 12.1 µR/h, the area in front of the disinfection barrier at 11.8 µR/h and the control plot of 100 × 100 m at 11.3 µR/h; the lowest value, 9.6 µR/h, was recorded in the calving house. All these figures lie within the limits of the natural radiation background, and the differences between the observation points are explained by the relief of the area, the physical properties of the soil and the uneven distribution of natural radionuclides. Laboratory examination showed that the radionuclide caesium-137 was not detected in the samples of alfalfa, straw or wheat. The radiation indicators of the soil and water samples likewise did not exceed the radiation safety norms in force. Taken together, the field measurements and the laboratory analyses show that the radiation background in the agroecosystem of the farm is at its natural level and that no contamination with technogenic radionuclides was observed.

Conclusion and contribution

The radioecological monitoring carried out in the agroecosystem of the Khoji-Ahmad farm in the Navbahor area of the Bekabad district permits the following conclusions. The ambient gamma dose rate in the study area lay between 9.6 and 14.5 µR/h and did not exceed the limits of the natural radiation background. The radiation indicators of the soil, water, feed and plant samples were found to comply with the radiation safety norms in force. Radiochemical analysis did not detect caesium-137 in the samples of alfalfa, straw or wheat, which confirms the radiological safety of the agricultural products. No signs of technogenic radioactive contamination were observed on the territory of the farm, and the radioecological state of the agroecosystem was assessed as stable. The results show that the feed and livestock products produced in the area meet radiation safety requirements and that no radiation hazard exists for human health or for the animals. At the same time, in order to maintain long-term control of the radiation situation, it is recommended that radioecological monitoring of agricultural land, water sources and feed

products be continued on a regular basis. The contribution of this work lies in providing documented baseline radiological values for a dairy agroecosystem situated in an industrial district, against which future measurements can be compared.

ADABIYOTLAR RO'YXATI

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RESEARCH ARTICLE • PEER-REVIEWED • OPEN ACCESS • HAC/OAK 16.00.00 — VETERINARY SCIENCES
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Results of practical research on aborted sheep for salmonellosis

Abort qilgan qo'ylarni salmonellyozga tekshirish amaliyoti natijalari

Результаты практических исследований абортировавших овец на сальмонеллёз

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)

ENGLISH

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Abstract. This article presents the results of a pathological examination of sheep that experienced abortion on a farm. During the study the gross pathological changes in the foetus and the placenta were evaluated with special attention to the differential diagnosis of salmonellosis. The results showed that the detected pathological changes alone were not sufficient to confirm a diagnosis of salmonellosis. The study emphasizes the importance of a comprehensive diagnostic approach, including pathological, bacteriological, serological and molecular investigations, to determine the aetiology of abortion in sheep accurately and to improve differential diagnosis.

Keywords: pathological examination; salmonellosis; *Salmonella abortus ovis*; diagnosis; differential diagnosis; abortion; foetus; placenta; campylobacteriosis; chlamydiosis

O'ZBEKCHA

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Annotatsiya. Maqolada fermer xo'jaligida abort qilgan qo'ylarda o'tkazilgan patologoanatomik tekshiruv natijalari tahlil qilindi. Tadqiqot davomida homila va yo'ldoshdagi makroskopik patologik o'zgarishlar o'rganilib, ularning salmonellyozga xos belgilari differensial diagnostika nuqtai nazaridan baholandi. Olingan natijalarga ko'ra, aniqlangan patologik o'zgarishlarning o'zi salmonellyoz tashxisini tasdiqlash uchun yetarli bo'lmadi. Tadqiqot natijalari qo'ylarda abortlarning sababini aniqlashda kompleks diagnostik yondashuv, jumladan patologoanatomik, bakteriologik va boshqa laboratoriya tekshiruvlarini birgalikda qo'llash muhimligini ko'rsatadi.

Kalit so'zlar: patologoanatomik tekshiruv; salmonellyoz; *Salmonella abortus ovis*; diagnoz; differensial diagnostika; abort; homila; yo'ldosh; kampilobakterioz; xlamidioz

РУССКИЙ

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Аннотация. В статье представлены результаты патологоанатомического исследования случаев аборта у овец, зарегистрированных в условиях фермерского хозяйства. Проведён анализ клинических признаков, макроскопических патологических изменений и результатов бактериологического исследования. Согласно результатам проведённых исследований, сальмонеллёзная этиология абортов не во всех случаях была подтверждена. Полученные данные подчёркивают необходимость комплексной дифференциальной диагностики инфекционных абортов у овец с использованием клинических, патологоанатомических и лабораторных методов исследования.

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Ключевые слова: патологоанатомическое исследование; сальмонеллёз; Salmonella abortus ovis; диагноз; дифференциальная диагностика; аборт; плод; плацента; кампилобактериоз; хламидиоз

1. KIRISH

Introduction

Qo'ychilik chorvachilikning asosiy tarmoqlaridan biri bo'lib, uning iqtisodiy samaradorligi sog'lom nasl olish va qo'ylar reproduktiv funksiyasining ko'rsatkichlariga bevosita bog'liqdir. Qo'ychilikda sohaning taraqqiyoti uchun qo'ylar orasida uchraydigan infeksiyon kasalliklarga qarshi samarali kurashish bo'yicha chora-tadbirlarning zamonaviy usullarini yaratish va tatbiq etish muhim hisoblanadi. To'1 mavsumida bo'g'oz sovliqlarda abortlar qayd etilishi xo'jaliklarga katta iqtisodiy zarar yetkazadi. Abortlarning asosiy sabablaridan biri yuqumli kasalliklar bo'lib, ular orasida salmonellyoz alohida ahamiyat kasb etadi.

Salmonellyoz — Salmonella enterica bakteriyalari chaqiradigan zoonoz kasallik bo'lib, bo'g'oz qo'ylarda yo'ldoshning yallig'lanishi, homilaning nobud bo'lishi va abort bilan namoyon bo'ladi. Tiрик tug'ilgan qo'zilar ham kasallik natijasida zaif bo'lib, ko'pincha yashashga layoqatsizligi tufayli qisqa vaqt ichida nobud bo'ladi yoki o'sish-rivojlanishda ortda qoladi.

2026-yilning to'1 mavsumida Jizzax viloyati Sharof Rashidov tumanidagi «Sardorjon» fermer xo'jaligida bo'g'oz sovliqlar orasida abort holatlari qayd etildi. Xo'jalik epizootologik jihatdan o'rganilib, klinik belgilar, patologoanatomik o'zgarishlar hamda laboratoriya tekshiruvlari o'tkazildi. Mazkur maqolani tayyorlashdan maqsad — fermer xo'jaligida kuzatilgan qo'ylar abortlarini epizootologik, klinik, patologoanatomik va laboratoriya tekshiruvlari asosida baholash hamda differensial diagnostikaning ahamiyatini yoritishdan iborat.

2. MATERIALLAR VA METODLAR

Materials and methods

Tadqiqotlar Jizzax viloyatining Sharof Rashidov tumanidagi qo'ychilik yo'nalishiga ixtisoslashgan «Sardorjon» fermer xo'jaligida olib borildi. Xo'jalikning asosiy faoliyati go'sht va nasldor qo'ylar yetishtirishdan iborat. Suruv veterinariya-sanitariya qoidalariga muvofiq parvarish qilinadi, hayvonlar mavsumiy yaylov hamda qo'ra sharoitida boqiladi. Oziqlantirish ratsioni pichan, somon, donli ozuqalar va mineral-vitamin qo'shimchalaridan tashkil topgan bo'lib, ichimlik suvi bilan doimiy ta'minlangan.

Xo'jalikda jami 300 bosh mayda shoxli hayvon mavjud bo'lib, shundan 240 boshini sovliqlar tashkil etadi. 2026-yilning aprel oyida ketma-ket bir necha kun davomida 20 bosh sovliqda abort sodir bo'lgan. Abortlar asosan bo'g'ozlikning oxirgi davrida kuzatilgan.

Hayvonlarning yoshi, fiziologik holati, homiladorlik muddati, saqlash va oziqlantirish sharoitlari hamda epizootologik vaziyat batafsil o'rganildi. Tekshiruv davomida homilaning tashqi ko'rinishi, ichki a'zolaridagi o'zgarishlar hamda yo'ldosh holatiga alohida e'tibor qaratildi. Abort qilingan homilalar va yo'ldoshlardan namunalar olinib, laboratoriya tekshiruvlari uchun yuborildi. Kasallikning etiologik sababini aniqlash maqsadida bakteriologik tekshiruvlar o'tkazildi hamda abort chaqiruvchi asosiy infeksiyalar bilan differensial diagnostika olib borildi.

3. NATIJALAR VA MUHOKAMA

Results and discussion

Abort qilgan sovliqlarda tana haroratining ko'tarilishi, ishtahaning pasayishi, holsizlanish, ayrim hayvonlarda esa ich ketishi kuzatildi. Ayrim homilalarda teri osti shishi, qorin va ko'krak bo'shlig'ida oz miqdorda seroz suyuqlik to'planishi qayd etildi.

Birlamchi patologoanatomik tekshirishlarda jigarning biroz kattalashgani, rangi qo'ng'ir-qizg'ish tusda bo'lib, yuzasida mayda nuqtasimon qon quyilishlarining rivojlanishi kuzatildi. Shuningdek, ayrim namunalarda taloq hajmining biroz kattalashuvi va o'pkada shish belgilari aniqlandi.



1-rasm. Xo'jalikda abort bo'lgan homilani tekshirish jarayoni / **Fig. 1.** Examination of an aborted foetus on the farm

Yo'ldosh tekshiruvda ayrim kotiledonlarda qalinlashish, giperemiya va nuqtasimon qon quyilishlar kuzatildi. Ayrim hollarda nekrotik o'choqlarga o'xshash o'zgarishlar qayd etildi; ushbu o'zgarishlar homila rivojlanishi jarayonining buzilganidan darak beradi.

Kuzatilgan patologoanatomik o'zgarishlar abort chaqiruvchi bir qator infeksiyon kasalliklarda uchrashi mumkin, shu sababli yakuniy tashxis laboratoriya natijalari asosida qo'yildi. Xo'jalikdan olib kelingan barcha patologik namunalarni bakteriologik tekshirishda 3 holatda salmonellyoz, 2 holatda xlamidioz va 4 holatda kampilobakterioz aniqlandi.



2-rasm. Patologik namunalarni laboratoriyada tekshirish jarayoni / **Fig. 2.** Laboratory examination of the pathological samples

4. XULOSA

Conclusion

O'tkazilgan patologoanatomik tekshiruvlar natijasida abort qilgan qo'ylarda ma'lum patologik o'zgarishlar kuzatilgan bo'lsa-da, laboratoriya tekshirishlarida abortlarning sababi to'liq salmonellyozga bog'lanmadi.

Epizootologik, klinik va patologoanatomik ma'lumotlar hamda laboratoriya tekshirishlari natijalari birgalikda baholanganda, mazkur abort holatlarining salmonellyoz bilan bog'liqligi qisman tasdiqlandi. Ushbu natijalar qo'ylarda abortlarni tashxislashda faqat klinik va patologoanatomik belgilar bilan cheklanib qolmasdan, bakteriologik va zamonaviy molekulyar usullarni qo'llash zarurligini ko'rsatadi. Shuningdek, qo'ylarda abort holatlarining kelib chiqishida salmonellyozdan tashqari brutsellyoz, kampilobakterioz, xlamidioz hamda oziqlantirish va saqlash sharoitlari bilan bog'liq noinfektsion omillar ham muhim rol o'ynashi mumkin.

Kelgusida qo'ylarda abort etiologiyasini yanada tez va to'g'ri aniqlash maqsadida bakteriologik tekshiruvlar bilan bir qatorda serologik, molekulyar-genetik hamda boshqa zamonaviy laboratoriya usullaridan foydalanish ilmiy va amaliy jihatdan maqsadga muvofiq hisoblanadi. Bunday yondashuv qo'ychilik xo'jaliklarida reprodaktiv yo'qotishlarni kamaytirish, iqtisodiy zararlarning oldini olish va epizootik osoyishtalikni ta'minlashga xizmat qiladi.

DECLARATIONS

Declarations

Author contributions *ORCID*

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing & editing. The author has read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Ethics approval

The work was carried out as part of routine diagnostic examination of material obtained from spontaneous abortions on a commercial farm, in accordance with the veterinary and sanitary rules in force in the Republic of Uzbekistan. No experimental procedures were performed on live animals and no human participants were involved.

Informed consent

The author has read and approved the final version of the manuscript and has given consent to its submission and publication. The owner of the farm agreed to the examination of the material and to the publication of the results. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the author upon reasonable request.

Conflict of interest

The author declares no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The author used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The author reviewed and verified all output and takes full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Sheep farming is one of the principal branches of animal husbandry, and its economic efficiency depends directly on obtaining healthy offspring and on the reproductive performance of the ewes. Abortions in pregnant ewes during the lambing season cause considerable economic damage to farms. One of the main causes of abortion is infectious disease, and among these salmonellosis is of particular importance. Salmonellosis is a zoonotic disease caused by bacteria of the species *Salmonella enterica*; in pregnant ewes it manifests itself as inflammation of the placenta, death of the foetus and abortion. Lambs born alive are weakened by the disease and often die within a short time because they are not viable, or lag behind in growth and development. In the lambing season of 2026, cases of abortion were recorded among pregnant ewes on the Sardorjon farm in the Sharof Rashidov district of the Jizzakh region. The purpose of this article is to evaluate these abortions on the basis of epizootiological, clinical, pathoanatomical and laboratory investigations and to demonstrate the importance of differential diagnosis.

Materials and methods

The investigations were carried out on the Sardorjon farm in the Sharof Rashidov district of the Jizzakh region, a holding specializing in sheep farming whose main activity is the production of meat and breeding sheep. The flock is maintained in accordance with veterinary and sanitary rules, and the animals are kept on seasonal pasture and in sheds. The feeding ration consists of hay, straw, grain feeds and mineral and vitamin supplements, with a constant supply of drinking water. The farm holds a total of 300 small ruminants, of which 240 are ewes. In April 2026 abortions occurred in 20 ewes over several consecutive days, mainly in the last period of pregnancy. The age, physiological state and stage of pregnancy of the animals, the housing and feeding conditions and the epizootiological situation were studied in detail. During the examination particular attention was paid to the external appearance of the foetus, to changes in its internal organs and to the condition of the placenta. Samples were taken from the aborted foetuses and placentas and sent for laboratory examination. Bacteriological investigations were carried out to establish the aetiology of the disease, and differential diagnosis was performed against the principal infections that cause abortion.

Results and discussion

In the ewes that aborted, an increase in body temperature, reduced appetite and weakness were observed, and in some animals diarrhoea. In some foetuses subcutaneous oedema and a small accumulation of serous fluid in the abdominal and thoracic cavities were recorded. Primary pathoanatomical examination revealed slight enlargement of the liver, which was brownish-red in colour, with small punctate haemorrhages developing on its surface. In some specimens a slight enlargement of the spleen and signs of pulmonary oedema were also detected. Examination of the placenta showed thickening, hyperaemia and punctate haemorrhages in some cotyledons, and in certain cases changes resembling necrotic foci, which indicate a disturbance of the process of foetal development. Since the pathoanatomical changes observed may occur in a number of infectious diseases that cause abortion, the final diagnosis was established on the basis of the laboratory results. Bacteriological examination of all pathological samples delivered from the farm detected salmonellosis in three cases, chlamydiosis in two cases and campylobacteriosis in four cases. The pathological changes observed were therefore not by themselves sufficient to confirm a diagnosis of salmonellosis, and the aetiology of the abortions proved to be mixed.

Conclusion and contribution

Although definite pathological changes were observed in the ewes that aborted, laboratory examination did not attribute the abortions wholly to salmonellosis. When the epizootiological, clinical and pathoanatomical data are assessed together with the laboratory findings, the connection of these abortion cases with salmonellosis is only partly confirmed. These results show that in diagnosing abortion in sheep it is not enough to rely on clinical and pathoanatomical signs alone: bacteriological and modern molecular methods must also be applied. Besides salmonellosis, brucellosis, campylobacteriosis and chlamydiosis, as well as non-infectious factors connected with feeding and housing conditions, may play an important part in the occurrence of abortion in sheep. In future, in order to establish the aetiology of ovine abortion more rapidly and accurately, it is expedient from both a scientific and a practical point of view to use serological, molecular-genetic and other modern laboratory

methods alongside bacteriological examination. Such an approach will help to reduce reproductive losses on sheep farms, to prevent economic damage and to maintain epizootic well-being. The contribution of this study lies in documenting a field case in which the gross lesions alone would have supported a diagnosis of salmonellosis, while bacteriology revealed a mixed aetiology — a result that argues directly for routine multi-method differential diagnosis.

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Comparative evaluation of the efficacy of different anthelmintic drugs against ovine dictyocaulosis

Qo'ylar diktiokaulyoziga qarshi qo'llanilgan turli antгельmint preparatlarining qiyosiy samaradorligi

Сравнительная оценка эффективности различных антигельминтных препаратов при диктиокаулёзе овец

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Abstract. This article presents the results of a comparative evaluation of the therapeutic efficacy of different anthelmintic drugs used for the control of ovine dictyocaulosis. A review of the available literature indicates that dictyocaulosis is widely distributed worldwide, with the prevalence of infection ranging from 18.7 to 75.5 per cent. Previous studies conducted in the Republic of Uzbekistan reported that the extent of invasion reached up to 65.5 per cent in certain regions. However, the current epizootic status of ovine dictyocaulosis, its distribution across different regions of the country, as well as the efficacy of commonly used anthelmintic drugs and the level of parasite resistance to them, remain insufficiently investigated. The present study comparatively evaluated the therapeutic efficacy of LEVAMISOLE 75 and RICAZOL®, manufactured by Nita-Farm LLC (Russian Federation), and IVERMEC 1 %, manufactured in the People's Republic of China. All of these drugs are officially registered in the Republic of Uzbekistan and are widely used in veterinary practice.

Keywords: sheep; helminth; helminthiasis; dictyocaulosis; larva; geohelminth; Dictyocaulus filaria; prevalence of infection; intensity of infection; deworming; LEVAMISOLE 75; RICAZOL®; IVERMEC 1 %

O'ZBEKCHA

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Annotatsiya. Mazkur maqolada qo'ylar diktiokaulyoziga qarshi kurashishda qo'llanilayotgan turli antгельmint preparatlarining qiyosiy terapevtik samaradorligini baholash natijalari keltirilgan. Adabiyotlar tahliliga ko'ra, diktiokaulyoz dunyoning ko'plab mamlakatlarida keng tarqalgan bo'lib, kasallikning uchrash darajasi 18,7–75,5 % ni tashkil etadi. O'zbekiston Respublikasida o'tkazilgan avvalgi tadqiqotlarda kasallikning ekstensivligi ayrim hududlarda 65,5 % gacha yetishi qayd etilgan. Shunga qaramay, hozirgi davrda respublikaning turli hududlarida diktiokaulyozning zamonaviy epizootik holati, tarqalish xususiyatlari, shuningdek amaliyotda qo'llanilayotgan antгельmint preparatlarining samaradorligi va ularga nisbatan parazitlarning rezistentlik darajasi yetarli darajada o'rganilmagan. Tadqiqot davomida O'zbekiston Respublikasida davlat ro'yxatidan o'tgan hamda chorva hayvonlari gelmintozlariga qarshi veterinariya amaliyotida keng qo'llanilayotgan Rossiya Federatsiyasining «Nita-Farm» MChJ tomonidan ishlab chiqarilgan LEVAMIZOL 75 va RIKAZOL®, shuningdek Xitoyda ishlab chiqarilgan IVERMEC 1 % antгельmint preparatlarining qiyosiy terapevtik samaradorligi o'rganildi va olingan natijalar tahlil qilindi.

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Kalit soʻzlar: qoʻylar; gelmint; gelmintoz; diktiokaulyoz; lichinka; geogelmint; Dictyocaulus filaria; invaziya ekstensivligi; invaziya intensivligi; degelmintizatsiya; LEVAMIZOL 75; RIKAZOL®; IVERMEC 1 %

РУССКИЙ

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Аннотация. В данной статье представлены результаты сравнительной оценки терапевтической эффективности различных антигельминтных препаратов, применяемых для борьбы с диктиокаулезом овец. Анализ литературных данных свидетельствует о том, что диктиокаулез широко распространен во многих странах мира, а уровень зараженности животных варьирует от 18,7 до 75,5 %. Согласно ранее проведенным исследованиям в Республике Узбекистан, экстенсивность инвазии в отдельных регионах достигала 65,5 %. Вместе с тем современное эпизоотическое состояние диктиокаулеза, особенности его распространения в различных регионах республики, а также эффективность применяемых антигельминтных препаратов и уровень резистентности паразитов к ним изучены недостаточно. В ходе исследований была проведена сравнительная оценка терапевтической эффективности препаратов ЛЕВАМИЗОЛ 75 и РИКАЗОЛ®, производимых ООО «Нита-Фарм» (Российская Федерация), а также препарата IVERMEC 1 %, произведенного в Китайской Народной Республике.

Ключевые слова: овцы; гельминт; гельминтоз; диктиокаулез; личинка; геогельминт; Dictyocaulus filaria; экстенсивность инвазии; интенсивность инвазии; дегельминтизация; ЛЕВАМИЗОЛ 75; РИКАЗОЛ®; IVERMEC 1 %

1. MAVZUNING DOLZARBLIGI

Relevance of the topic

Dunyo miqyosida qishloq xoʻjaligi hayvonlarining parazitlar kasalliklarini tarqalishini oʻrganish, davolash va qarshi kurashishning optimal muddatlarini ishlab chiqish hamda ularni profilaktika qilish boʻyicha bir qancha chora-tadbirlar amalga oshirilmoqda. Shundan kelib chiqqan holda, kasallik qoʻzgʻatuvchilarining arealini, tur tarkibini va bioekologik xususiyatlarini oʻz vaqtida aniqlash, ularga qarshi ilmiy asoslangan kurashish, davolash va oldini olish choralarini hududlarning biogeografik va ekologik holatini baholash bilan birga olib borish yuqori samara beradi.

Respublikamizda mustaqillik yillarida agrosanoat majmuining asosiy tarmoqlaridan biri boʻlgan chorvachilikni rivojlantirish borasida keng qamrovli chora-tadbirlar amalga oshirildi. Mazkur yoʻnalishda olib borilgan rejali chora-tadbirlar natijasida chorva mollarning yuqumli, yuqumsiz va invazion kasalliklarga chalinishi sezilarli darajada kamayib, chorva mollari soni oshdi.

Shu bilan birga, mamlakatimizga keyingi 20 yilda chetdan turli zotga mansub qoramollar, qoʻy-echkilar va boshqa chorva hayvonlarining olib kelinayotgani, chorvachilikda xoʻjalik yuritish shakllarining (aholi, fermer, dehqon, klaster) rivojlanib borayotgani chorva mollarning turli parazitlar kasalliklari tarqalish darajasini oʻrganish hamda ularga qarshi davolash va profilaktika chora-tadbirlarini takomillashtirishga qaratilgan izlanishlarga alohida eʼtibor qaratish zarurligini bildiradi.

2. ADABIYOTLAR TAHLILI

Literature review

Mualliflarning tahlillariga koʻra, bugungi kunda respublikamiz sharoitida chorva hayvonlarining turli gelmintoz kasalliklariga qarshi 240 dan ortiq antgelmint vosita qoʻllanilib kelinmoqda. Ushbu antgelmint vositalarning 200 dan ortigʻi chetdan valyuta hisobiga kirib kelsa, 40 tasi respublikamizda ishlab chiqariladi. Shuningdek, qoʻllanilayotgan antgelmint preparatlarning 110 tasi suspenziya shaklida, 48 tasi tabletki, 41 tasi bolyus, 15 tasi granula, 11 tasi eritma va qolganlari gel, pasta hamda tomchi shakllarida qoʻllaniladi [3].

Bugungi kunda gelmintozlarga qarshi qoʻllanilayotgan antgelmint vositalar — albendazol (alben, albenol, albet, valbazen, orivermin), fenbendazol (panakur, fenkur, vermitan), mebendazol (mebenvet), kambendazol (kamban, MK-905), parbendazol (gelmatak, verminum), asetamizol (2-ASB), shuningdek nilverm (tetramizol, nemitsid, nilzan, oovermol, sitarin, askaridil, apperkal, konkurat, dikaris, veterin-vermizol, vetanizol) kimyoviy jihatdan benzimidazollar guruhiga mansub boʻlib, ular turli gelmintozlarni davolash va oldini olishda qoʻllanilib kelinmoqda [2].

Baʼzi mualliflar mayda shoxli mollarning diktiokaulyoziga qarshi kurashish uchun levamizol va oksfendazol asosidagi kombi-natsiyalangan preparat — levoksni qoʻllaganlar; invaziya intensivligi 97,88 % boʻlganda 4,25 mg/kg dozada 90 %, 5,31 mg/kg dozada esa 100 % samaradorlikka erishilgan [1]. Boshqa tadqiqotchilar taʼkidlashicha, levamizol jinsiy voyaga yetgan diktiokaualarga jinsiy voyaga yetmaganlariga nisbatan samaraliroqdir [7].

Tadqiqotchilar kavsh qaytaruvchi hayvonlarning diktiokaulyoziga qarshi ivermektin preparatlarining yuqori samaradorlikka egaligini qayd etishgan [9, 10]. Shuningdek, diktiokaulyoz va boshqa gelmintozlarning oldini olish uchun ivermektin kapsulalarini 1,7 mg/kg dozada 100 kun davomida qoʻllash orqali samarali natija olingani koʻrsatilgan [8].

Koʻpgina tadqiqotchilarning maʼlumotlariga koʻra, qoʻzilarning diktiokaulyozdan oʻlim darajasi kasal hayvonlar sonining 12 foizini tashkil qiladi. Turli yillarda qoʻylar oʻlimining 25–82 % diktiokaulyoz tufayli sodir boʻlgani, diktiokaulyoz bilan zararlangan yosh hayvonlarning tirik vazni ortishi 38 foizdan koʻproq kamayishi qayd etilgan [5].

Qoʻylar diktiokaulyozining epizootik xususiyatlarini kengroq oʻrganish, kasallikning tarqalish qonuniyatlarini aniqlash hamda samarali profilaktika va davolash choralarini ishlab chiqish chorvachilikda iqtisodiy zararlarni kamaytirish va sohaning barqaror rivojlanishini taʼminlashda muhim ilmiy-amaliy ahamiyat kasb etadi.

3. MATERIALLAR VA METODLAR

Materials and methods

Toshkent viloyati Ohangaron tumanidagi «HOLTORAEV OYBEK-HM» fermer xo'jaligidan 96 bosh qo'ydan tezak namunalari olindi va gelmintlarvoskopik usullardan Berman-Orlovning O'zVITI da modifikatsiyalangan usulida tekshirildi. Tekshirish natijalariga ko'ra, 96 bosh qo'ydan 54 boshi (56,2 %) diktiokauloz bilan ekstens zararlangani aniqlandi.

Har bir qo'yning yoshi, rangi va birka raqami qayd etilib, olingan tezak namunasi laboratoriya sharoitida tekshirildi. Diktiokaulalar bilan zararlangan 54 bosh qo'y to'rt guruhga — uchta tajriba guruhiga 13 boshdan hamda bitta nazorat guruhiga 8 bosh qilib ajratildi. Birinchi tajriba guruhidagi qo'ylarga IVERMEC 1 % preparatidan 10 kg tirik vazniga 0,2 ml teri ostiga, ikkinchi tajriba guruhidagi qo'ylarga LEVAMIZOL 75 preparatidan 10 kg tirik vazn hisobidan 1 ml mushak orasiga, uchinchi tajriba guruhidagi qo'ylarga esa 10 kg vazniga nisbatan 0,4 ml miqdorda RIKAZOL® preparati mushak orasiga qo'llanildi. To'rtinchi — nazorat guruhidagi 8 bosh zararlangan qo'ylarga antelmint preparatlar qo'llanilmadi. Barcha guruhlarda preparat berilganidan 7 kun o'tgach takroriy gelmintarvoskopik tekshiruv o'tkazildi.

4. NATIJALAR VA MUHOKAMA

Results and discussion

Tajriba natijalari 1-jadvalda keltirilgan. Jadval ma'lumotlarini tahlil qilsak, birinchi tajriba guruhidagi 13 bosh qo'y gelmintarvoskopik tekshirilganda ular 100 % diktiokaulalar bilan ekstens zararlangani, invazyani intensivligi esa minimal 17, maksimal 68, o'rtacha 42 nusxani tashkil etgani aniqlandi. Ushbu guruhdagi qo'ylarga IVERMEC 1 % antelmint preparatidan 10 kg tirik vazniga nisbatan 0,2 ml teri ostiga yuborildi va 7 kundan keyin qayta gelmintarvoskopik tekshiruvdan o'tkazildi. Takroriy tekshiruv xulosasiga ko'ra, IVERMEC 1 % antelmint vositasining ushbu miqdori 100 foiz ekstens samara berdi.

Ushbu preparat qo'llanmasida chorva mollarining oshqozon-ichak strongilyatozlariga — bunostomum, Cooperia, chabertiya, gemonxus, nematodirus, ezofagostomum, strongilyus va trixostrogilyuslarga, shuningdek lichinkali telaziya hamda gipodermalarga va bit-kanalarga qarshi qo'llanilishi qayd etilgan. Ammo qo'llanmada o'pka nematodalariga, xususan

1-jadval

Qo'ylar diktiokauloziga qarshi IVERMEC 1 %, LEVAMIZOL 75 va RIKAZOL® antelmint vositalari samaradorligini qiyosiy o'rganish natijalari / **Table 1.** Comparative efficacy of IVERMEC 1 %, LEVAMISOLE 75 and RICAZOL® against ovine dictyocaulosis

Guruh raqami	Antgelmint vositalar nomi, miqdori va qo‘llanish shakli	Qo‘ylar soni	Antgelmintlar berilguncha						Antgelmintlar berilgach 7 kundan keyin						Samaradorlik, % ES
			IE			II			IE			II			
			soni	%	min	mak	o‘rtacha	soni	%	min	mak	o‘rtacha			
1-tajriba guruhi	IVERMEC 1 % — 10 kg / 0,2 ml, teri ostiga	13	13	100	17	68	42	—	—	—	—	—	100		
2-tajriba guruhi	LEVAMIZOL 75 — 10 kg / 1,0 ml, mushak orasiga	13	13	100	22	57	39	3	23	5	9	7	77		
3-tajriba guruhi	RIKAZOL® — 10 kg / 0,4 ml, mushak orasiga	13	13	100	15	75	45	1	7,7	6	6	6	92,3		
Nazorat guruhi	—	8	8	100	18	56	35	15	100	18	62	40	—		

IE — invaziya ekstensivligi; II — invaziya intensivligi (bir namunadagi lichinkalar soni).

5. XULOSALAR

Conclusions

1. Qo'ylar diktiokauloziga qarshi qiyosiy sinovdan o'tkazilgan uch turdagi antelmint preparat orasida Xitoyda ishlab chiqarilgan IVERMEC 1 % preparati (10 kg tirik vazniga 0,2 ml, teri ostiga

diktiokaulalarga qarshi qo'llanilishi ko'rsatilmaganligi sababli ushbu preparat ham sinovdan o'tkazildi va uning yuqori samaradorligi haqida ma'lumotga ega bo'lindi.

Ikkinchi tajriba guruhida 13 bosh qo'y diktiokaulalar bilan ekstens zararlangan bo'lib, invazyani intensivligi minimal 22, maksimal 57 va o'rtacha 39 nusxani tashkil etdi. Ushbu qo'ylarga LEVAMIZOL 75 preparatidan 10 kg vazniga 1 ml miqdorda mushak orasiga yuborildi. 7 kundan keyin takroriy gelmintarvoskopik tekshirganda 13 bosh qo'yning 10 tasi diktiokaulalardan to'liq ozod bo'lgani, 3 boshida esa diktiokaulalar aniqlanib, invazyani intensivligi pasaygani qayd etildi: o'rtacha 39 nusxadan 7 nusxagacha kamaydi. LEVAMIZOL 75 antelmint preparatining qo'ylar diktiokauloziga qarshi ekstens samaradorligi 77 % ni tashkil etdi. Shuni alohida ta'kidlash kerakki, ushbu preparatning qo'llanmasida diktiokaulalarga qarshi samaradorligi qayd etilgan bo'lsa-da, u bizning tajribalarimizda qo'ylarni diktiokaulalardan to'liq ozod qilmadi.

Uchinchi tajriba guruhidagi 13 bosh qo'ya 100 foiz ekstens zararlaniş hamda minimal 15, maksimal 75 va o'rtacha 45 nusxada diktiokaula lichinkalari bilan intens zararlaniş aniqlandi. So'ngra qo'ylarning 10 kg tirik vazniga nisbatan 0,4 ml miqdorda RIKAZOL® preparati mushak orasiga qo'llanildi. 7 kundan keyingi gelmintarvoskopik tekshirishda 13 bosh qo'ydan 1 boshida (7,7 %) diktiokaulalar aniqlandi, ya'ni preparatning ekstens samaradorligi 92,3 % ni tashkil etdi.

Nazoratdagi to'rtinchi guruhdagi zararlangan qo'ylarga antelmint preparatlar qo'llanilmadi. Dastlabki tekshirishda ushbu guruhda 8 bosh qo'y diktiokaulalar bilan zararlangan bo'lib, invazyani intensivligi minimal 18, maksimal 56 va o'rtacha 35 nusxani tashkil etdi. 7 kundan keyingi takroriy gelmintarvoskopik tekshirishda zararlangan qo'ylar soniga yana 7 bosh qo'shilib, ularning umumiy soni 15 taga yetdi. Invazyani intensivligi ham ortdi: maksimal 56 nusxadan 62 nusxagacha va o'rtacha 35 nusxadan 40 nusxagacha ko'paydi. Bu esa davolanmagan oilalarda invaziya o'z-o'zidan kamaymasligini, aksincha kuchayib borishini ko'rsatadi.

Yuqorida qiyosiy o'rganilgan uchta antelmint preparat orasida Xitoyda ishlab chiqarilgan IVERMEC 1 % preparati diktiokaulozga qarshi eng samarador antelmint vosita ekanligi ma'lum bo'ldi.

yuborilganda) eng yuqori terapevtik samaradorlikni namoyon etib, 100 % ekstensiv samaradorlikka ega ekanligi aniqlandi.

2. Rossiya Federatsiyasining «Nita-Farm» MChJ tomonidan ishlab chiqarilgan RIKAZOL® preparati (10 kg tirik vazniga 0,4 ml, mushak orasiga yuborilganda) qo'ylar diktiokauloziga qarshi 92,3 % ekstensiv samaradorlik ko'rsatdi.

3. Rossiya Federatsiyasining «Nita-Farm» MChJ tomonidan ishlab chiqarilgan LEVAMIZOL 75 preparati (10 kg tirik vazniga 1,0 ml, mushak orasiga yuborilganda) qoʻylar diktiokaulyoziga qarshi 77,0 % ekstensiv samaradorlik koʻrsatgani aniqlandi.

DECLARATIONS

Declarations

Author contributions *CRedit*

Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

The study was carried out on a commercial sheep farm as part of ordinary therapeutic deworming practice, in accordance with the veterinary and sanitary requirements in force in the Republic of Uzbekistan and with the agreement of the owner of the farm. All preparations were used at the doses and by the routes stated in their registered instructions. No human participants were involved.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The owner of the farm agreed to the trial and to the publication of the results. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the table of the article and are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare no conflict of interest. The manufacturers of the preparations tested had no part in the design of the study, in the collection or analysis of the data or in the preparation of the manuscript.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

A wide range of measures is being carried out worldwide to study the distribution of parasitic diseases of farm animals, to determine the optimal timing of treatment and control and to prevent these diseases. Timely determination of the range, species composition and bioecological characteristics of the pathogens, combined with an assessment of the biogeographical and ecological state of the territories concerned, gives the highest effect. In Uzbekistan extensive measures have been carried out to develop animal husbandry, and as a result the incidence of infectious, non-infectious and invasive diseases of livestock has fallen appreciably while animal numbers have grown. At the same time, the import of cattle, sheep and goats of various breeds over the past twenty years and the development of different forms of farming — household, farmer, dehqan and cluster — make it necessary to study the distribution of parasitic diseases and to improve treatment and preventive measures. According to the literature, dictyocaulosis is widespread in many countries, with prevalence between 18.7 and 75.5 per cent, and earlier studies in Uzbekistan recorded an extent of invasion of up to 65.5 per cent in certain regions; nevertheless the present epizootic status

of the disease, the features of its distribution and the efficacy of the anthelmintics used in practice, together with the level of parasite resistance to them, remain insufficiently studied. The aim of this work was to compare the therapeutic efficacy of three anthelmintic preparations registered in the Republic of Uzbekistan — LEVAMISOLE 75 and RICAZOL®, produced by Nita-Farm LLC of the Russian Federation, and IVERMEC 1 %, produced in China — against dictyocaulosis of sheep.

Materials and methods

Faecal samples were collected from 96 sheep on the HOLTORAEV OYBEK-HM farm in the Akhangaran district of the Tashkent region and examined by the helmintholaryoscopic method of Berman and Orlov as modified at the Scientific-Research Institute of Veterinary. The age, colour and ear-tag number of each sheep were recorded. Examination showed that 54 of the 96 sheep, or 56.2 per cent, were infected with Dictyocaulus. The 54 infected sheep were divided into four groups: three experimental groups of 13 head each and one control group of 8 head. Sheep of the first experimental group received IVERMEC 1 % subcutaneously at 0.2 ml per 10 kg of live weight; sheep of the second group received LEVAMISOLE 75 intramuscularly at 1.0 ml per 10 kg of live weight; sheep of the third group received RICAZOL® intramuscularly at 0.4 ml per 10 kg of live weight. The eight infected sheep of the fourth, control group received no anthelmintic. Seven days after treatment all groups were re-examined by the same helmintholaryoscopic method, and both the extent of invasion (the proportion of infected animals) and the intensity of invasion (the number of larvae per sample, recorded as minimum, maximum and mean) were determined before and after treatment.

Results and discussion

Before treatment all four groups were 100 per cent infected. In the first experimental group the intensity of invasion was 17 larvae at minimum, 68 at maximum and 42 on average; seven days after subcutaneous administration of IVERMEC 1 % at 0.2 ml per 10 kg no larvae were detected in any animal, giving an extensive efficacy of 100 per cent. It should be noted that the manufacturer's instruction for this preparation lists activity against gastrointestinal strongylatodes — Bunostomum, Cooperia, Chabertia, Haemonchus, Nematodirus, Oesophagostomum, Strongylus and Trichostrongylus — and against Thelazia larvae, Hypoderma and lice and mites, but does not mention lung nematodes and in particular Dictyocaulus; the preparation was therefore included in the trial, and its high efficacy against this parasite was established. In the second experimental group the intensity of invasion before treatment was 22 at minimum, 57 at maximum and 39 on average; seven days after intramuscular administration of LEVAMISOLE 75 at 1.0 ml per 10 kg, 10 of the 13 sheep were completely free of Dictyocaulus while larvae were still detected in three animals, the mean intensity falling from 39 to 7 larvae; the extensive efficacy was 77.0 per cent. Although the instruction for this preparation states activity against Dictyocaulus, in the present experiment it did not free the sheep of the parasite completely. In the third experimental group the intensity of invasion before treatment was 15 at minimum, 75 at maximum and 45 on average; seven days after intramuscular administration of RICAZOL® at 0.4 ml per 10 kg, larvae were found in only one of the 13 sheep, that is in 7.7 per cent, corresponding to an extensive efficacy of 92.3 per cent. In the untreated control group all eight sheep remained 100 per cent infected after seven days, and the intensity of invasion rose from a maximum of 56 to 62 larvae and from a mean of 35 to 40 larvae, confirming that the reduction observed in the experimental groups was due to the preparations and not to natural fluctuation. Of the three anthelmintics compared, IVERMEC 1 %, produced in China, proved to be the most effective against ovine dictyocaulosis.

Conclusion and contribution

Of the three anthelmintic preparations subjected to comparative testing against ovine dictyocaulosis, IVERMEC 1 %, produced in China and administered subcutaneously at 0.2 ml per 10 kg of live weight, showed the highest therapeutic efficacy, with an extensive efficacy of 100 per cent. RICAZOL®, produced by Nita-Farm LLC of the Russian Federation and administered intramuscularly at 0.4 ml per 10 kg of live weight, showed an extensive efficacy of 92.3 per cent against ovine dictyocaulosis. LEVAMISOLE 75, produced by the same company and administered intramuscularly at 1.0 ml per 10 kg of live weight, showed an extensive efficacy of 77.0 per cent. The practical contribution of this

work is twofold: it establishes a clear efficacy ranking for three preparations that are actually on the Uzbek market, and it documents that a preparation whose label makes no claim against lung nematodes nevertheless cleared *Dictyocaulus* completely, while a preparation that does carry such a claim did not.

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Aetiology, pathogenesis and clinical signs of laminitis in cattle

Qoramollarda laminitlarning etiologiyasi, patogenez va klinik belgilari**Этиология, патогенез и клинические признаки ламинита у крупного рогатого скота****S. B. SULAYMANOV¹, Kh. B. NIYOZOV¹, A. I. RUZIYEV¹**¹ Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnologies, Uzbekistan**ARTICLE INFO****ARTICLE TYPE**

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)**ENGLISH****S. B. SULAYMANOV¹, Kh. B. NIYOZOV¹, A. I. RUZIYEV¹**¹ Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnologies, Uzbekistan

Abstract. Laminitis is one of the most common orthopaedic diseases affecting high-producing dairy cows and represents a significant economic challenge in modern cattle production. This article presents a review and analysis of national and international scientific literature on the aetiology, pathogenesis and clinical manifestations of laminitis in cattle. The analysis revealed that the major risk factors contributing to the development of the disease include subacute ruminal acidosis, endotoxaemia, disturbances of microcirculation, nutritional imbalances and inadequate housing conditions. Laminitis induces morphofunctional alterations in the hoof lamellar apparatus, resulting in lameness, reduced milk production and impaired reproductive performance. Early diagnosis of the disease and the improvement of preventive strategies are essential for increasing the economic efficiency and sustainability of cattle farming.

Keywords: cattle; laminitis; aetiology; pathogenesis; metabolism; pH; ruminal acidosis; keratinization; microcirculation; lameness; productivity

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Annotatsiya. Laminit yuqori mahsuldor sog'in sigirlarda uchraydigan va katta iqtisodiy ahamiyatga ega bo'lgan ortopedik kasalliklardan biri hisoblanadi. Ushbu maqolada qoramollarda laminitning etiologiyasi, patogenez va klinik belgilari bo'yicha mahalliy va xorijiy adabiyotlar tahlil qilindi. Tadqiqotlar natijasida kasallikning rivojlanishida subakut rumen atsidozi, endotoksemiya, mikrotsirkulyatsiya buzilishlari, oziqlantirishdagi xatolar hamda saqlash sharoitlarining nomutanosibligi asosiy xavf omillari ekanligi aniqlandi. Laminit tuyuq lamellyar apparatida morfofunktsional o'zgarishlarni keltirib chiqarib, oqsoqlik, sut mahsuldorligining pasayishi va reproduktiv ko'rsatkichlarning yomonlashishiga sabab bo'ladi. Kasallikni erta aniqlash va profilaktika chora-tadbirlarini takomillashtirish qoramolchilikda iqtisodiy samaradorlikni oshirishda muhim ahamiyatga ega.

Kalit so'zlar: qoramol; laminit; etiologiya; patogenez; metabolism; pH; rumen atsidozi; keratinizatsiya; mikrotsirkulyatsiya; oqsoqlik; mahsuldorlik

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Аннотация. Ламинит является одним из наиболее распространённых ортопедических заболеваний высокопродуктивных молочных коров и представляет значительную экономическую

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проблему в современном животноводстве. В настоящей статье проведён анализ отечественной и зарубежной научной литературы, посвящённой вопросам этиологии, патогенеза и клинических проявлений ламинита у крупного рогатого скота. По результатам анализа установлено, что основными факторами риска развития заболевания являются субакутный ацидоз рубца, эндотоксемия, нарушения микроциркуляции, погрешности в кормлении, а также несоответствующие условия содержания животных. Развитие ламинита сопровождается морфофункциональными изменениями ламеллярного аппарата копыт, что приводит к возникновению хромоты, снижению молочной продуктивности и ухудшению репродуктивных показателей.

Ключевые слова: крупный рогатый скот; ламинит; этиология; патогенез; метаболизм; pH; ацидоз рубца; кератинизация; микроциркуляция; хромота; продуктивность

1. MAVZUNING DOLZARBLIGI

Relevance of the topic

Davlatimiz tomonidan chiqarilayotgan bir qator farmon va qarorlar chorvachilik mahsulotlarini ko'paytirishga qaratilgan bo'lib, respublikamiz aholisini sifatli go'sht va sut bilan ta'minlash bugungi kunning dolzarb masalalaridan biri hisoblanadi. Ayniqsa, mahsuldor sigirlar orasida aseptik laminit kasalliklarining ko'plab uchrashi oqibatida fermer xo'jaliklari va aholiga qarashli sigirlarda mahsuldorlikning keskin pasayishi, sut va sut mahsulotlarining kamayishi hamda yuqori mahsuldor hayvonlardan foydalanish muddatlarining qisqarishi hisobiga katta iqtisodiy zarar ko'rilmog'ida. Shuning uchun ushbu holatni bartaraf etish maqsadida kasallikning uchrash darajasini o'rganish, davolash va oldini olishni takomillashtirish dolzarb vazifalardan biri hisoblanadi.

Adabiyotlar tahlili shuni ko'rsatadiki, sigirlarda laminitlar chorvachilikning intensivlashuvi bilan bog'liq holda eng ko'p uchraydigan ortopedik kasalliklardan biri hisoblanadi. Ko'plab mualliflarning ta'kidlashicha, laminitlar yuqori mahsuldor sigirlarda ko'proq qayd etilib, bu holat asosan ratsion tarkibining nomutanosibligi va metabolik buzilishlar bilan bog'liq.

2. ADABIYOTLAR TAHLILI

Literature review

Laminit tuyuq terisining diffuz aseptik yallig'lanishi bo'lib, yakka tuyuqli hayvonlarda (otlarda) uchraydi. Kasallik o'rganilgan va adabiyotda yaxshi tasvirlangan. Juft barmoqli kavsh qaytaruvchi hayvonlarda bu kasallik uzoq vaqt davomida amaliy ahamiyatga ega emas edi [1]. Mahsuldor sigirlarda laminit kasalligi to'g'risidagi adabiyot manbalarining ko'pchiligi chet el olimlari tomonidan keltirilgan; otlarda laminit haqida esa alohida maqolalar ko'p bo'lib, ularda qisqacha ma'lumotlar keltirilgan [2].

Tadqiqotchilar ma'lumotiga ko'ra, Sibirda sog'in sigirlarda laminit keng tarqalgan bo'lib, uning uchrash darajasi 50–60 % ni tashkil etadi [3]. Laminit — tuyuqlar dermasining diffuz aseptik yallig'lanishi bo'lib, aksariyat hollarda undan oldin shox kapsulasida funksional va morfologik o'zgarishlarga olib keladigan tizimli kasallik — katta qorin atsidozi yoki endometrit paydo bo'ladi [4, 5].

Ayrim tadqiqotchilar laminit rivojlanishining bir necha bosqichi mavjudligini ta'kidlaydilar. Laminitning dastlabki faollashuvi tizimli metabolik o'zgarishlar bilan bog'liq. Ushbu bosqich katta qorin buzilishi va keyinchalik tizimli pH buzilishining natijasidir. Qon muddatidan oldin arteriyalardan venalarga qaytariladi; kislorod va qon orqali o'tadigan boshqa oziq moddalar shox hosil qiluvchi to'qimalarga (koriumga) yetib bormaydi va shu bilan tomirlarda qon bosimini oshiradi [6, 7]. Mualliflarning ta'kidlashicha, tuyuqdagi qon aylanishining buzilishi laminit rivojlanishi bilan bog'liq asosiy etiologik omil hisoblanadi. Ushbu patologiyada kuchli vazodilatator va arterial konstriktor bo'lgan gistamin faol rol o'ynaydi. Katta qorindagi pH darajasi, ichakdagi gistamin konsentratsiyasi va hayvonning sog'lig'i o'rtasida to'g'ridan-to'g'ri bog'liqlik mavjudligi qayd etilgan; gistamin sintezi

katta qorinda mikroblar populyatsiyasining o'zgarishi bilan bog'liq [8, 9].

Tuyuq shoxining sifati keratinizatsiyaga bog'liq bo'lib, shox hujayraning strukturaviy qattiqligi va mustahkamligini beradi. Laminit bilan bog'liq qon tomir disfunktsiyasi hujayra darajasida korium to'qimalariga ta'sir qiladi. Bu juda muhim masala, chunki shox koriumdan yaxshi qon ta'minlanishiga bog'liq bo'lgan keratinotsitlar deb nomlanuvchi maxsus epidermal hujayralar tomonidan hosil qilinadi. Keratinotsitlar koriumdan oziq moddalarni bazal membrana orqali diffuziya yo'li bilan oladi. Keratinizatsiya — bu keratinotsitlarning keratin oqsillarini ishlab chiqarish jarayoni bo'lib, ular hujayra uchun tizimli yordamni ta'minlaydi va shuning uchun tuyuq shoxining qattiqligi hamda mustahkamligini ta'minlaydi. Keratinotsitlar teri (yoki shox) yuzasiga nisbatan ko'chib o'tganda, ular asta-sekin koriumdan diffuziya orqali yetarli miqdorda oziqa ololmaydigan darajaga yetadi. Bu hujayra o'limiga va kornifikatsiyaga olib keladi — bu jarayonda hujayra qattiqlashadi va keratinlashadi. Natijada yallig'lanish yuzaga kelib, keratinotsitlar ortiqcha zararlanishi mumkin. Oxir-oqibat sifatsiz shox hosil bo'ladi; shunday qilib, yomon shox hosil bo'lishiga sabab bo'luvchi omillardan biri laminit, ayniqsa subklinik laminit rivojlanishi hisoblanadi [10].

Mualliflarning ta'kidlashicha, yirik shoxli hayvonlarda tuyuq laminitidan chorvachilikda sut ishlab chiqarishning kamayishi, bepustlik hamda hayvonlarni mahsuldorligi pasayishi natijasida hisobdan chiqarish katta iqtisodiy zarar keltiradi. Xorijiy olimlar o'z ilmiy tadqiqotlarida tuyuq va barmoq kasalliklaridan kelib chiqadigan bir yillik iqtisodiy zarar har 100 bosh sigir uchun 1750 dan 3724 AQSH dollarigacha bo'lishini aniqladilar [11].

3. TADQIQOT MAQSADI

Aim of the study

Qoramollarda laminitning etiologiyasi, patogenezi va klinik belgilari bo'yicha mavjud ilmiy ma'lumotlarni tahlil qilish hamda kasallikning rivojlanish mexanizmlari va profilaktika choralarini umumlashtirish.

4. MATERIALLAR VA TADQIQOT USULLARI

Materials and methods

Tadqiqot obyekti sifatida mahalliy va xorijiy olimlarning laminit bo'yicha e'lon qilingan ilmiy ishlari, monografiyalari, xalqaro konferensiyalar materiallari va taqrib qilinuvchi jurnallarda chop etilgan maqolalar xizmat qildi.

Tadqiqot jarayonida bibliografik tahlil, qiyosiy baholash, ma'lumotlarni tizimlashtirish va ilmiy umumlashtirish usullaridan foydalanildi. Laminitning rivojlanish mexanizmlari, klinik namoyon bo'lishi va profilaktika choralarini bo'yicha turli mualliflar fikrlari tahlil qilindi.

5. NATIJALAR TAHLILI

Results and discussion

Ko'plab tadqiqotchilarning fikricha, laminit mustaqil kasallik sifatida emas, balki organizmda kechayotgan tizimli metabolik buzilishlarning mahalliy ifodasi sifatida qaralishi lozim. Xususan,

yuqori mahsuldor sigirlarda laktatsiyaning dastlabki bosqichlarida kuzatiladigan energiya tanqisligi, katta miqdorda konsentrat ozuqalarning berilishi va ratsion tarkibida samarali tolaning yetishmasligi katta qorin muhitida chuqur biokimyoviy o'zgarishlarni keltirib chiqaradi.

Zamonaviy tadqiqotlar ma'lumotlariga ko'ra, laminit polietologik xususiyatga ega bo'lib, uning rivojlanishida bir qator endogen va ekzogen omillar ishtirok etadi. Asosiy etiologik omillar sifatida ratsion tarkibida tez parchalanuvchi uglevodlarning me'yordan ortiq bo'lishi, yetarli miqdorda tolali ozuqalarning yetishmasligi, subkut rumen atsidozi, endotoksemiya, tug'ruqdan keyingi endometritlar, mineral va vitaminlar tanqisligi hamda zoogiyenik sharoitlarning qoniqarsizligi qayd etiladi.

Subkut rumen atsidozi sharoitida katta qorin muhitining pH ko'rsatkichi pasayadi, mikrobiotsenoz tarkibi o'zgaradi va biologik faol moddalar, jumladan gistamin miqdori ortadi. Bu esa o'z navbatida tuyuq to'qimalarida qon aylanishining buzilishiga olib keladi. Ratsionda kraxmal va yengil hazm bo'ladigan uglevodlarning ortiqcha bo'lishi natijasida katta qorinda sut kislotasi miqdori oshib ketadi; bu holat rumen muhitining pH ko'rsatkichini fiziologik me'yordan pasayishiga olib keladi. Natijada sellyuloza parchalovchi mikroflora faoliyati susayadi va grammusbat kislotasevar mikroorganizmlar ustunlik qila boshlaydi. Rumen muhitidagi mazkur o'zgarishlar oqibatida endotoksinlar, biogen aminlar va gistamin miqdori ortadi. Gistamin qon tomirlari devoriga ta'sir ko'rsatib, ularning fiziologik faoliyatini izdan chiqaradi; ayniqsa tuyuq dermasidagi mikrotsirkulyatsiya tizimi bunday ta'sirlarga yuqori darajada sezuvchan hisoblanadi.

Laminit patogenezining asosiy bosqichlaridan biri tuyuq to'qimalarida mikrotsirkulyatsiyaning buzilishidir. Qon tomirlar tonusining o'zgarishi, arteriovenoz shuntlarning faollashishi va kapillyarlar o'tkazuvchanligining ortishi natijasida tuyuq dermasida shish, gipoksiya va trofik o'zgarishlar rivojlanadi. Gipoksiya sharoitida hujayralarda energetik almashinuv buzilib, adenozintrifosfat sintezi kamayadi; bu esa shox hosil qiluvchi to'qimalarning fiziologik faoliyatiga salbiy ta'sir ko'rsatadi. Mikrotsirkulyatsiya buzilganda keratinotsitlarning trofikasi yomonlashadi va keratin sintezi jarayoni izdan chiqadi. Natijada tuyuq shoxining mexanik mustahkamligi pasayadi, elastikligi kamayadi hamda tashqi ta'sirlarga nisbatan chidamliligi yo'qoladi.

Keratinizatsiya jarayonining buzilishi tuyuq devorida va tovon qismida bir qator morfologik o'zgarishlarni keltirib chiqaradi. Jumladan, tuyuq devorida gorizontaal halqalar hosil bo'lishi, oq chiziqning kengayishi, shox qatlamining yumshashi, tovon eroziyalari va ikkilamchi infeksiya jarayonlarga moyillikning ortishi kuzatiladi. Ushbu o'zgarishlar keyinchalik oq chiziq kasalligi, tovon yaralari va barmoq dermatitlari kabi ikkilamchi ortopedik patologiyalarning rivojlanishi uchun zamin yaratadi.

Laminitning klinik kechishi o'tkir, surunkali va subklinik shakllarda namoyon bo'ladi. O'tkir shaklda hayvonlarda harakatlanish og'irqli bo'lib, ular ko'proq yotishga intiladi. Tuyuq harorati oshadi, raqamli arteriyalarda pulsatsiya kuchayadi va palpatsiya paytida og'irlik reaksiyasi qayd etiladi. Hayvonlar yurish vaqtida ehtiyotkorlik bilan harakatlanib, tanasining og'irligini orqa oyoqlarga ko'proq o'tkazishga harakat qiladi.

Surunkali laminitda patologik jarayonlar uzoq muddat davom etishi natijasida tuyuq shaklining deformatsiyalanishi kuzatiladi: tuyuq devori uzayadi, tovon qismi pasayadi, barmoq o'qi o'zgaradi va hayvonlarda turg'un oqsoqlik rivojlanadi. Bunday hayvonlarda ozuqa iste'moli pasayadi, jismoniy faollik cheklanadi va mahsuldorlik ko'rsatkichlari keskin yomonlashadi.

Subklinik laminit amaliyot nuqtai nazaridan eng xavfli shakl hisoblanadi, chunki tashqi klinik belgilari yaqqol namoyon bo'lmashligi sababli kasallik ko'pincha o'z vaqtida aniqlanmaydi. Biroq tuyuq shoxida kechayotgan morfofunksional o'zgarishlar keyinchalik og'ir ortopedik kasalliklarning rivojlanishiga sabab bo'ladi. Ayrim mualliflarning ma'lumotlariga ko'ra, yuqori

mahsuldor podalarda subklinik laminit tarqalishi klinik shakllarga nisbatan bir necha barobar yuqori bo'lishi mumkin.

6. XULOSALAR

Conclusions

1. Laminit yuqori mahsuldor qoramollarda keng tarqalgan va katta iqtisodiy ahamiyatga ega bo'lgan polietologik kasallik hisoblanadi. Kasallikning asosiy etiologik omillari sifatida subkut rumen atsidozi, endotoksemiya, oziqlantirishdagi xatolar va zoogiyenik omillar namoyon bo'ladi.

2. Patogenez asosida tuyuq dermasida mikrotsirkulyatsiyaning buzilishi, gipoksiya va keratinizatsiya jarayonining izdan chiqishi yotadi. Laminit oqsoqlik, sut mahsuldorligining pasayishi, reproduktiv ko'rsatkichlarning yomonlashishi va hayvonlarning erta yaroqsizlanishiga olib keladi.

3. Kasallikning oldini olish uchun ratsionlarni ilmiy asosda balanslashtirish, tuyuqlarni muntazam profilaktik parvarish qilish, saqlash sharoitlarini yaxshilash va subkut rumen atsidozini erta aniqlash muhim ahamiyatga ega.

DECLARATIONS

Declarations

Author contributions *CRedit*

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

The article is a review of published scientific literature. The work involved no experiments on animals and no human participants, and therefore required no separate ethics committee approval.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data discussed in this review are taken from the publications listed in the reference list and are available from those sources.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, transliteration of the Uzbek text from Cyrillic into the Latin script, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

A number of decrees and resolutions adopted by the state are directed at increasing the output of livestock products, and providing the population of the republic with high-quality meat and milk is one of the pressing tasks of the present day. The frequent occurrence of aseptic laminitis among productive cows causes farms and private owners considerable economic damage through a sharp fall in productivity, a reduction in milk and dairy products and a shortening of the productive

life of high-yielding animals. Analysis of the literature shows that laminitis in cows is one of the most common orthopaedic diseases associated with the intensification of animal husbandry; many authors note that it is recorded more often in high-producing cows and is connected mainly with an unbalanced ration and metabolic disturbances. Laminitis is a diffuse aseptic inflammation of the corium of the hoof, long known in solipeds and well described in horses, whereas in cloven-hoofed ruminants it was for a long time of little practical importance. Most of the literature on laminitis in productive cows comes from foreign authors, and researchers report a prevalence of 50–60 per cent among dairy cows in Siberia. The aim of this article is to analyse the available scientific data on the aetiology, pathogenesis and clinical signs of laminitis in cattle and to generalize the mechanisms of its development and the measures for its prevention.

Materials and methods

The object of the study was the published scientific work of national and foreign scholars on laminitis, including monographs, materials of international conferences and papers published in peer-reviewed journals. Eleven sources were analysed. The methods used were bibliographic analysis, comparative evaluation, systematization of data and scientific generalization; the opinions of different authors on the mechanisms of development of laminitis, on its clinical manifestation and on preventive measures were compared. The review was structured around three groups of questions: the endogenous and exogenous factors reported as aetiological; the sequence of pathogenetic events from ruminal disturbance through microcirculatory failure to disordered keratinization; and the clinical forms of the disease together with the secondary orthopaedic pathologies that follow from it.

Results and discussion

According to many researchers, laminitis should be regarded not as an independent disease but as the local expression of systemic metabolic disturbances in the organism. In high-producing cows the energy deficit observed in the early stages of lactation, the feeding of large quantities of concentrates and the shortage of effective fibre in the ration produce deep biochemical changes in the ruminal environment. Modern data show that laminitis is polyaetiological: the principal factors are an excess of rapidly fermentable carbohydrates in the ration, a shortage of fibrous feeds, subacute ruminal acidosis, endotoxaemia, post-partum endometritis, deficiency of minerals and vitamins, and unsatisfactory zoohygienic conditions. Under subacute ruminal acidosis the pH of the rumen falls, the composition of the microbiocenosis changes and the quantity of biologically active substances, including histamine, increases. An excess of starch and easily digestible carbohydrates raises the concentration of lactic acid in the rumen and lowers pH below the physiological norm; the activity of cellulolytic microflora declines and acid-tolerant gram-positive microorganisms begin to predominate, so that endotoxins, biogenic amines and histamine accumulate. Histamine, a powerful vasodilator and arterial constrictor, acts on the walls of the blood vessels and disturbs their physiological function, and the microcirculatory system of the hoof corium is highly sensitive to such effects. Disturbance of microcirculation in the tissues of the hoof is one of the key stages of pathogenesis: changes in vascular tone, the opening of arteriovenous shunts and increased capillary permeability lead to oedema, hypoxia and trophic changes in the corium. Under hypoxia the energy metabolism of the cells is disturbed and the synthesis of adenosine triphosphate falls, which impairs the physiological activity of the horn-forming tissues. The horn is produced by specialized epidermal cells, the keratinocytes, which obtain nutrients from the corium by diffusion through the basal membrane; when microcirculation is disturbed their trophic supply deteriorates and keratin synthesis fails. As a result the mechanical strength and elasticity of the hoof horn decrease and its resistance to external influences is lost. Disordered keratinization produces a series of morphological changes in the hoof wall and sole: horizontal rings on the wall, widening of the white line, softening of the horn layer, sole erosions and an increased tendency to secondary infection, which in turn create the basis for white line disease, sole ulcers and digital dermatitis. Clinically the disease occurs in acute, chronic and subclinical forms. In the acute form movement is painful, the animals tend to lie down, the temperature of the hoof rises, pulsation of the digital arteries increases and a pain reaction is recorded on palpation; the animals move cautiously and shift the weight of the body onto the hind limbs. In the chronic form the prolonged pathological process deforms the hoof: the wall lengthens, the sole is lowered, the axis of the

digit changes and persistent lameness develops, feed intake falls, physical activity is limited and productivity deteriorates sharply. The subclinical form is the most dangerous in practice, because the absence of obvious external signs means that the disease often goes undetected in time, while the morphofunctional changes proceeding in the hoof horn later give rise to severe orthopaedic disease; according to some authors the prevalence of subclinical laminitis in high-producing herds may be several times higher than that of the clinical forms. Foreign researchers have established that the annual economic loss from diseases of the hoof and digits amounts to between 1 750 and 3 724 US dollars per 100 cows.

Conclusion and contribution

Laminitis is a widespread polyaetiological disease of high-producing cattle with considerable economic significance; its principal aetiological factors are subacute ruminal acidosis, endotoxaemia, errors in feeding and zoohygienic factors. Its pathogenesis rests on disturbance of microcirculation in the corium of the hoof, hypoxia and failure of the process of keratinization, and it leads to lameness, reduced milk production, impaired reproductive performance and the early culling of animals. For the prevention of the disease, the scientifically based balancing of rations, regular preventive hoof care, improvement of housing conditions and early detection of subacute ruminal acidosis are of major importance. The contribution of this review lies in assembling, for veterinary practice in Uzbekistan, a coherent account of the chain that runs from ration composition through ruminal pH and histamine release to microcirculatory failure and defective horn formation, and in drawing attention to the subclinical form as the point at which prevention is both possible and economically decisive.

ADABIYOTLAR RO'YXATI

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CONTENTS

Volume 5, Issue 7, 2026 • 11 articles

16.00.00 — VETERINARY SCIENCES

Evaluation of the effectiveness of control measures against American and European foulbrood in honey bees <i>M. Yu. RAXIMOV, Sh. K. BALIYEV, X. A. SAFAROV, K. Sh. AKRAMOV</i> [UZ]	15
Methods for the diagnosis and control of dermatomycosis (saprolegniosis) in snakehead fish <i>Sh. K. BALIYEV, N. A. SULAYMANOVA</i> [UZ]	20
Distribution of cattle trematodosis pathogens in the agroecosystems of the Fergana Valley (literature review) <i>O. MURODULLAYEV, J. M. ISAYEV</i> [UZ]	26
Clinical symptoms, seasonal dynamics and diagnosis of eimeriosis <i>U. M. ABBOSOV, A. Kh. KHUSHNAZAROV</i> [UZ]	31
Histomorphological assessment of a drug complex in experimental tuberculosis of calves <i>O. A. DJURAEV</i> [EN]	36
Pathomorphological evaluation of the antituberculosis efficacy of Rifizostrep in experimental calf tuberculosis <i>G. Kh. MAMADULLAEV, O. A. DJURAEV, O. K. DJURAKULOV</i> [RU]	39
Radiological monitoring of environmental objects on farms in the Bekabad district of the Tashkent region <i>B. N. KHAKIMOV, H. N. HOJIQULOV, J. R. AYUPOVA</i> [UZ]	45
Monitoring the radioecological state of the agroecosystem of the Navbahor area, Bekabad district, Tashkent region (a case study of the Khoji-Ahmad farm) <i>B. N. KHAKIMOV, H. N. HOJIQULOV, J. R. AYUPOVA</i> [UZ]	49
Results of practical research on aborted sheep for salmonellosis <i>O. M. ABDURAIMOVA</i> [UZ]	53
Comparative evaluation of the efficacy of different anthelmintic drugs against ovine dictyocaulosis <i>Laylo Sh. SHARIPOVA, Nurbek E. YULDASHEV</i> [UZ]	57
Aetiology, pathogenesis and clinical signs of laminitis in cattle <i>S. B. SULAYMANOV, Kh. B. NIYOZOV, A. I. RUZIYEV</i> [UZ]	62

MUNDARIJA / СОДЕРЖАНИЕ

Har bir maqola o'zi yozilgan tilda keltirilgan / Каждая статья приведена на языке оригинала

16.00.00 — VETERINARIYA FANLARI	
Asalarilarda Amerika va Yevropa chirish kasalliklariga qarshi kurashish choralarining samaradorligini baholash <i>RAXIMOV M.Yu., BALIYEV Sh.K., SAFAROV X.A., AKRAMOV K.Sh.</i> [UZ]	15
Ilonbosh baliqlarida dermatomikoz (saprolegnioz)ni aniqlash va qarshi kurash usullari <i>BALIYEV Sh.K., SULAYMANOVA N.A.</i> [UZ]	20
Farg'ona vodiysi agroekotizimlarida qoramollar trematodozlari qo'zg'atuvchilarining tarqalishi (adabiyotlar sharhi) <i>MURODULLAYEV O., ISAYEV J.M.</i> [UZ]	26
Eymeriozning klinik belgilari, mavsumiy dinamikasi va diagnostikasi <i>ABBOSOV U.M., XUSHNAZAROV A.X.</i> [UZ]	31
Histomorphological assessment of a drug complex in experimental tuberculosis of calves <i>O. A. DJURAEV</i> [EN]	36
Патоморфологическая оценка противотуберкулёзной эффективности препарата Рифизостреп при экспериментальном туберкулёзе телят <i>МАМАДУЛЛАЕВ Г.Х., ДЖУРАЕВ О.А., ДЖУРАКУЛОВ О.К.</i> [RU]	39
Toshkent viloyati Bekobod tumanidagi fermer xo'jaliklarida atrof-muhit obyektlarining radiologik monitoringi <i>XAKIMOV B.N., HOJIQULOV H.N., AYUPOVA J.R.</i> [UZ]	45
Toshkent viloyati Bekobod tumani Navbahor hududidagi agroekotizimning radioekologik holatini monitoring qilish («Xoji-Ahmad» fermer xo'jaligi misolida) <i>XAKIMOV B.N., HOJIQULOV H.N., AYUPOVA J.R.</i> [UZ]	49
Abort qilgan qo'ylarni salmonellyozga tekshirish amaliyoti natijalari <i>ABDURAIMOVA O.M.</i> [UZ]	53
Qo'ylar diktiokaulioziga qarshi qo'llanilgan turli antгельmint preparatlarining qiyosiy samaradorligi <i>SHARIPOVA Laylo Sharipovna, YO'LDASHEV Nurbek Ergashevich</i> [UZ]	57
Qoramollarda laminittlarning etiologiyasi, patogenezi va klinik belgilari <i>SULAYMANOV S.B., NIYOZOV H.B., RUZIYEV A.I.</i> [UZ]	62

HAC / OAK: Included in the list of national scientific publications of the Higher Attestation Commission (HAC) under the Academy of Sciences of the Republic of Uzbekistan, recommended for publishing the main scientific results of dissertations in 06.00.00 Agricultural Sciences and 16.00.00 Veterinary Sciences.

OAK / HAC: O'zbekiston Respublikasi Fanlar akademiyasi huzuridagi OAK ro'yxatiga kiritilgan: 06.00.00 – Qishloq xo'jaligi fanlari; 16.00.00 – Veterinariya fanlari.

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