IRSTI 34.35.17 https://doi.org/10.26577/EJE2025821012

A.B. Kaliyeva[1], I.Yu. Chidunchi[1], Sh.Zh. Arynova[1*], Z.M. Sergazinova[1], N.P. Korogod[2]

[1]Toraighyrov University, Pavlodar, Kazakhstan
[2]Margulan University, Pavlodar, Kazakhstan
*e-mail: shinar_uzh@mail.ru

ECOLOGICAL SUBSTANTIATION OF CONTROL MEASURES AGAINST HORSEFLIES (DIPTERA, TABANIDAE) IN THE STEPPE ZONE OF NORTH-EASTERN KAZAKHSTAN

The largest livestock-breeding region of our country is the north-east of Kazakhstan. In order to ensure veterinary well-being of the region and profitability of livestock development, it is important to solve a number of situational tasks. In conditions of sharp-continental climate of the north-east of Kazakhstan one of the main aspects of development, preservation and increase of productivity of cattle population is the most common measures to minimize the damage caused by blood-sucking two-winged insects, including horseflies. As a result of the conducted studies, it was revealed that in the season of insect activity milk productivity of cattle decreased up to 30%, and loss of live weight of young cattle varied from 25% to 40% per day when attacked by dominant species of horseflies. As a result of conducted researches in Pavlodar Priirtyshye 27 species of horseflies belonging to 5 genera were identified. Faunistic complex of the region is represented by European, Turkestan, Mediterranean, Mongolian and Central Asian groups, with predominance of boreal species. The highest species diversity and population density were observed in intrazonal landscapes of the middle Yertis floodplain. Two peaks of mass activity of horseflies have been established: in June and July, which is caused by irregularity of their departure. The main places of occurrence are floodplain lakes, channels and swamps. The activity of gadfly attacks is determined by climatic conditions, with the main influence of temperature and light intensity. The obtained data on seasonal and daily activity of horseflies can be used to develop effective measures to control their mass species.

Key words: entomology, horseflies, bloodsucking two-winged, gnus, livestock, insects, control measures, insecticides.

А.Б. Калиева[1], И.Ю. Чидунчи[1], Ш.Ж. Арынова[1*], З.М. Сергазинова[1], Н.П. Корогод[2]

[1] Торайғыров университеті, Павлодар, Қазақстан
[2] Марғұлан университеті, Павлодар, Қазақстан
*e-mail: shinar_uzh@mail.ru

Солтүстік-Шығыс Қазақстанның дала аймағы жағдайында соналарға (diptera, tabanidae) қарсы күрес шараларының экологиялық негіздемесі

Қазақстанның солтүстік-шығысы республиканың ірі мал шаруашылығы аймақтарының бірі болып табылады. Мал шаруашылығын табысты дамыту үшін бірқатар бірінші кезектегі мәселелерді шешу, ең алдымен, республика үшін аса маңызды салада ветеринарлық саланы қамтамасыз ету қажет. Солтүстік-шығыс Қазақстан жағдайында мал басын сақтаудың және мал өнімділігін арттырудың негізгі резервтерінің бірі – малға қансорғыш жіңішке жәндіктердің, соның ішінде секіргіш шыбындардың әсерінен болатын зиянды жою. Массалардың жаппай шабуылы кезінде сиырлардың сүт өнімділігі 25-30%-ға төмендейтіні, ал жас малдардың жәндіктердің белсенді кезеңінде тәулігіне 25-40%-ға дейін тірілей салмағын жоғалтатыны белгілі. Павлодар Ертіс өңірінде жүргізілген зерттеулер нәтижесінде 5 тұқымдасқа жататын 27 шоңайнақ түрі анықталды. Аймақтың фауналық кешені еуропалық, түркістандық, жерорта теңіздік, моңғолдық және ортаазиялық топтармен ұсынылған, бореалдық түрлер басым. Орта Ертіс жайылмасының интразональдық ландшафттарында ең көп түрлердің әртүрлілігі мен популяциясының тығыздығы байқалады. Шоңайнақтардың жаппай белсенділігінің екі шыңы белгіленді: маусым және шілде айларында, бұл олардың ұшуының бұзылуына байланысты. Негізгі пайда болатын жерлер – жайылма көлдер, арналар мен батпақтар. Соналардың шабуылының белсенділігі климаттық жағдайлармен анықталады, ал температура мен жарықтың қарқындылығы негізгі әсер етеді. Сона

шыбындарының маусымдық және тәуліктік белсенділігі туралы алынған мәліметтер олардың кең таралған түрлерімен күресудің тиімді шараларын әзірлеу үшін пайдаланылуы мүмкін.

Түйін сөздер: энтомология, соңалар, қан сорғыш қосқанаттылар, гнус, мал шаруашылығы, жәндіктер, бақылау шаралары, инсектицидтер.

А.Б. Калиева[1], И.Ю. Чидунчи[1], Ш.Ж. Арынова[1*],
З.М. Сергазинова[1], Н.П. Корогод[2]

[1] Торайгыров университет, Павлодар, Казахстан
[2] Маргулан университет, Павлодар, Казахстан
*e-mail: shinar_uzh@mail.ru

Экологическое обоснование мер борьбы со слепнями (diptera, tabanidae) в условиях степной зоны Северо-Восточного Казахстана

Крупнейшим животноводческим регионом нашей страны является северо-восток Казахстана. С целью обеспечения ветеринарного благополучия региона и рентабельности развития животноводства важно решение ряда ситуационных задач. В условиях резко-континентального климата северо-востока Казахстана одним из главных аспектов развития, сохранения и повышения продуктивности поголовья крупного рогатого скота наиболее распространены мероприятия по минимизации ущерба, наносимого кровососущими двукрылыми насекомыми, в том числе слепнями. В результате проведенных исследований, было выявлено, что в сезон активности насекомых молочная продуктивность у крупного рогатого скота снижалась до 30 %, а потеря живой массы у молодняка варьировалась от 25 до 40 % в сутки при нападении доминантных видов слепней. В результате проведенных исследований в Павлодарском Прииртышье выявлено 27 видов слепней, относящихся к 5 родам. Фаунистический комплекс региона представлен европейской, туркестанской, средиземноморской, монгольской и центрально-азиатской группами, с преобладанием бореальных видов. Наибольшее видовое разнообразие и плотность населения отмечены в интразональных ландшафтах поймы среднего Иртыша. Установлены два пика массовой активности слепней: в июне и июле, что обусловлено нерегулярностью их вылета. Основными местами появления являются пойменные озера, протоки и болота. Активность нападения слепней определяется климатическими условиями, при этом основное влияние оказывают температура и интенсивность освещения. Полученные данные о сезонной и суточной активности слепней могут быть использованы для разработки эффективных мер борьбы с их массовыми видами.

Ключевые слова: энтомология, слепни, кровососущие двукрылые, гнус, животноводство, насекомые, меры борьбы, инсектициды.

Introduction

The species composition, distribution, variability and ecological features of horseflies have been studied in Kazakhstan in different years and by different scientists-biologists. The level of negative impact of gadfly toxicity is revealed by the mass of dominant species, duration of flight and prevalence in the study area. Gadflies as massively distributed ectoparasites cause serious damage to cattle, reducing their milk production and live weight. Gadfly bites are not only distressing but also pose a risk of transmission of various diseases such as anthrax, tularemia, trypanosomiasis in camels, horses and cattle, infectious anemia in horses and other poorly understood diseases of domestic and wild animals. At the same time, in tropical regions gadflies are vectors of filariasis (loiasis) in humans and wild animals. Due to their widespread prevalence, horseflies cause significant economic damage to thousands of livestock farms located in the territory of the Republic of Kazakhstan and commonwealth countries (Skulovec, 2005: 412), (Isimbekov, 1994: 35), (Sivkova, 2019: 575-579), (Sivkova, 2022: 251-258), (Miraballes, 2019: 579-593), (Shevchenko, 1985: 130-149).

In 1975, the first study of the species composition of the Palearctic horseflies was carried out by M. Leclerg and N. Olsufiev (1977), which was the reason for writing a monograph in which they described and systematized 195 species of horseflies of the fauna of the commonwealth countries. Along with the abovementioned authors there are researches of other authors on finding new species of horseflies in Kazakhstan. The study of horseflies in different natural zones of the Republic, including mountain systems Tarbagatai, Saur, Southern Altai, as well as Karkarala and Bayanaul mountain forest massif, including deserts and steppes, intrazonal landscapes of the Yertis river valley and other regions, contributed to a more extensive characterization of the faunistic composition of these insects. In the period from 2004 to 2009 the study of faunistic diversity of horseflies in South-West Altai, in particular in Katon-Karagai district on

summer pastures of red deer in high-mountainous terrain significantly enriched and clarified their systematic classification. Thus, the fauna of horseflies of Kazakhstan has 84 species and 2 subspecies of horseflies, it was enriched with 12 species of insects, described earlier by V.V. Shevchenko (1961). Shevchenko (1961). We would like to note that the above list is not complete and is supplemented as new data appear, which allows us to expand knowledge about the fauna of tabanids (Krolow, 2017a: 107), (Krolow, 2022b: 447-457), (Aldabergenov, 1975: 28), (Rodrigues, 2022: 518–522), (Zhanetov, 1975: 28), (Nurlina, 2009: 120), (Fermino, 2019: 1-17), (Skuf'in, 1973: 104).

In Russia the study of species composition, gonotrophic cycle, peculiarities of gadfly development, starting from the end of the 19th century and up to the present time has been carried out by a number of authors and large research institutes and laboratories, such as All-Russian Research Institute of Veterinary Entomology and Arachnology (Tyumen), Zoological Institute (St. Petersburg), Institute of Systematics and Ecology of Animals SB RAS (Novosibirsk).

The main approaches in the fight against horseflies are sanitary and preventive measures aimed at reducing and regulating their numbers. The most common and effective method is the use of chemical preparations. An important aspect of this issue is the choice of not only the most effective preparations, but also environmentally safe means, as well as the definition and development of optimal methods and modes of their application, corresponding to the conditions of specific regions. A review of the current scientific literature revealed that the best results in terms of efficacy and duration of insecticidal action, as well as safety for animals and ecosystems are demonstrated by preparations presented in the form of individual polymeric plates, such as ear tags and tail tapes. The active substances of the above-mentioned preparations are released evenly and for a long period of time and penetrate into the ducts of sebaceous glands, gradually spreading over the entire surface of the animal's body, causing the death of blood-sucking two-winged insects in contact with the skin and hair cover of the animal. This form of the drug is characterized by low consumption, and synthetic pyrethroids and their combinations used as active components are relatively safe for animals and humans. This is due to the fact that they are rapidly metabolized in animals and rapidly degraded in the environment, which makes them more compliant with environmental safety standards (Ma, 2023: 286), (Andrianov, 2023: 578-584).

Material and methods of research

The material for the study was own collections of gadflies. Entomological collections of insects were carried out in the north-east of Kazakhstan (Pavlodar oblast), in different natural-climatic conditions. Collection of winged forms was carried out with a standard entomological net during a certain period of time in places of cattle grazing and mowing on vegetation, by method of catching from animals. The captured adult forms of horseflies were placed in entomological stain with ether. After killing, the insects were pricked on entomological pins or spread on cotton mattresses. The species affiliation of horseflies was determined using a microscope MBS-10 and special identifiers edited by V. V. Shevchenko and N. G. Olsufiev (Engashev, 2019a: 34-37), (Engashev, 2020b: 5-8), (Isimbekov, 1994: 35), (Krolow, 2017a: 107), (Krolow, 2022b: 447-457)

Seasonal changes in the number of gadflies were studied by regular collections once a decade from the time of their appearance in spring to their disappearance in autumn. Counting collections were 20-minute captures at the beginning of each hour – from 8 to 20 hours. In total, about 500 specimens of gadfly winged forms were collected.

Scientific articles, reviews and reports of a number of authors and scientific laboratories served as material for analyses of effective measures of gadfly control.

Results and discussion

As a result of our research we identified 27 species of horseflies belonging to 5 genera: *Chrysops relictus Mg., Tabanus sabuletorum sabuletorum Lw, T. maculicornis Ztt., Tabanus b. bromius Zinne., Tabanus bromius flavofemoratus Strobl., T. bovinus L., T. autumnalis autumnalis, Tabanus autumnalis brunessens Szil., Atylotus pallitarsis Ols., Atylotus rusticus L., Hybomitra lurida Flln, Hybomitra nitidifrons nitidifrons, Hybomitra nitidifrons nitidifrons confiformis, Hybomitra sareptana Szil., Hybomitra distinquenda distinquenda Verr., Hybomitra ciureai, Hybomitra muehlfeldi Br., Hybomitra bimaculata Macq., Hybomitra lundbecki lundbecki Lyn, Hybomitra montana montana Mg., Hybomitra montana morgani Surc., Hybomitra expollicata expollicata Pand., Hybomitra erberi Br., Haematopota pallidula Krob., Haematopota subcylindrica Pand., Haematopota pluvialis pluvialis L., Haematopota turkestanica turkestanica Krob.*

Figure 1 – Types of horseflies

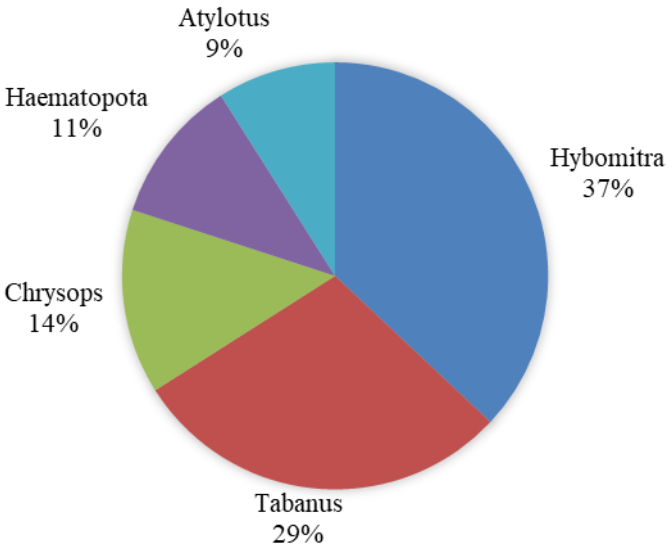

Figure 2 – Quantitative ratio of horseflies

In Kazakhstan gadflies are represented by European, Turkestan, Mediterranean, Mongolian and Central Asian faunal groups. Faunistic composition of horseflies of Pavlodar region is represented by boreal species belonging to forest-steppe and European-Siberian forest species. Nevertheless, the distribution of horseflies in natural zones of the region differs both in quantitative and qualitative indicators. In the intrazonal landscape of the middle part of the Ertis River valley the faunistic diversity of species and the highest density of tabanids were revealed.

In the middle reaches of the Yertis River we traced the flight of the Common Pestling from 30 June to 2 August. The period of tabanid activity was detected from 9 a.m. to late evening and was accompanied by annoying attacks on humans and animals. It was recorded that in the period from

12 to 13 hours there was an active flight of gadflies. In the study area (upper reaches of the river Ertis) tabanids fly from the beginning of July to the end of July, being active during the daytime from 10 to 20 pm. The highest activity of Tabanus females is observed from 12-14 hours at temperatures of 28-30 ºC. Atylotus pallitarsis inhabits birch-aspen groves and mixed grass meadows with willow overgrowth, is rare, fly from the second to the third decade of summer. According to our observations, in the floodplain of the Ertis River Atylotus rusticus species is active from mid-June to mid-August, while in the Bayanaulsky mountainous forest massif it starts its flight later – from the first decade of July and continues until the first decade of August. These insects are most active in attacking animals and people between 8 am and 8 pm. The greatest intensity of the gadfly attack occurs from 12 to 13 hours at a temperature of 30-32 ºC. In the floodplain of the Yertis River we traced the flight of gadflies of the genus Hybomitra from the second decade of June to the third decade of August. Haematopota subcylindrica is dominant in the upper Yertis River valley, especially in the dry-steppe plain part; it flies from the beginning of the second decade of June to the end of July (Table 1).

Table 1 – Daily flying activity of horseflies in the intrazonal landscape of the Yertis River floodplain

№	Types of gadflies	Trapping time in hours			Maximum flight time in hours
		The first one	Mass flight	The last one	
1	*Chr. relictus*	9-10	12-13	21-22	13
2	*T. s. sabuletorum*	8-9	12-14	20-22	14
3	*T. b. bromius*	10-11	12-14	20	10
3a	*T. b. flavofemoratus*	9-10	11-13	19	10
4	*T. bovinus*	7-8	13-16	20-22	15
5	*T. a. autumnalis*	6-7	8-11; 17-19	21	15
5a	*T. a. brunescens*	7-8	14-15	18-20	13
6	*A. rusticus*	8-9	12-13	19-20	12
7	*H. n. nitidifrons*	8-9	11-12	20	12
7a	*H. n. confiformes*	7-8	11-13	19-20	13
8	*H. sareptana*	9-10	11-12	18-19	10
9	*H. d. distinguenda Verr.*	8-9	10-13	20-22	14
10	*H. ciureai*	8-9	12-14	20-22	14
11	*H. muehlfeldi Br.*	7-8	12-15	18-19	12
12	*H. l. lundbecki*	8-9	11-12	19-20	12
13	*H. m. montana*	8-9	12-14	20-21	13
13a	*H. m. morgani*	8-9	12-13	20-21	13
14	*H. exp. expollicata*	8-9	10-13	18-19	11
15	*H. erberi*	8-9	12-13	17-20	12
16	*Haem. subcylindrica*	7-8	11-13	18-20	13
17	*Haem. p. pluvialis*	7-8	11-14	18-21	14
18	*Haem. turkestanica*	8-9	12-13	17-20	12

Compiled by the authors based on the results of observation of the daily rhythm of gadfly activity.

Thus, in the intrazonal landscape of the Yertis River floodplain and the adjacent plain steppe gadflies are active from June to the end of August. Due to irregularity of departure of gadflies distributed there in floodplain biotopes two periods of their mass activity were marked: the first period of activity was recorded from the second to the third decade of June and lasted up to 15 days; the second peak was recorded from the end of the first decade of July and lasted 3 weeks.

In spite of short duration of the gadfly season of 75-80 days, the period of their mass annoyance to animals is 30-40 days, i.e. 40-50 % of the season of activity.

Such species as T. bovinus L., T. autumnalis autumnalis, Hybomitra nitidifrons confiformis, Haematopota subcylindrica occur everywhere in the studied region and belong to dominant and mass species. According to our data, in the valley of the middle reaches of the Yertis River, in the afforested floodplain, Haematopota pluvialis pluvialis is also a mass species. Detailed data are presented in figure 3.

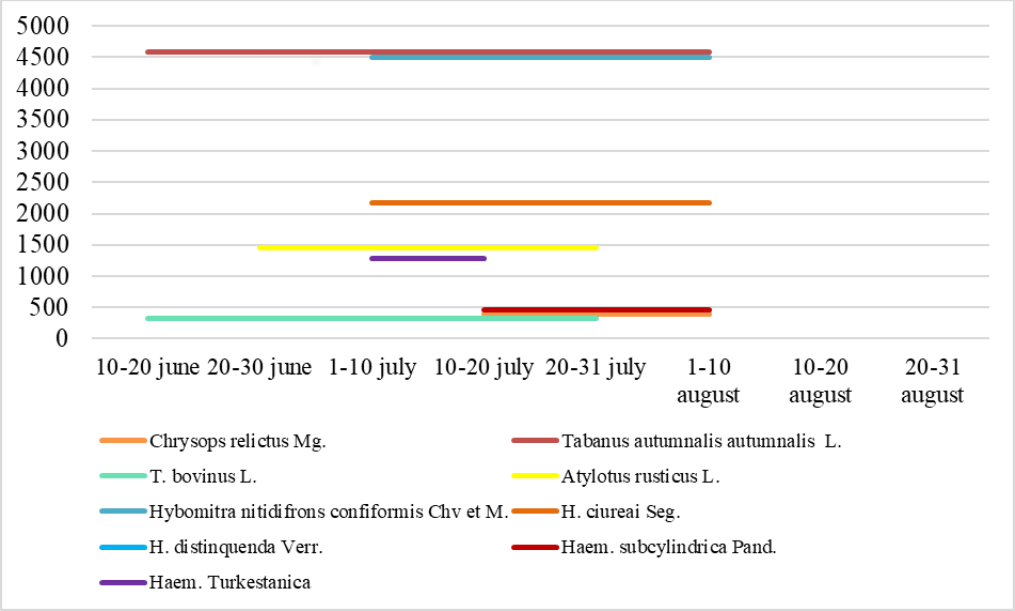

Figure 3 – Seasonal course of abundance of mass species of horseflies in the plain part of Pavlodar Priirtyshye (based on cattle counts)

In different natural zones, as the results of our studies showed, the places of gadfly emergence are confined to overgrown banks of lakes, streams, channels, bogs, extensive swamps. This once again indicates the difficulty of identification and study of ecology of preimaginal phases of gadfly development.

In different natural zones, as the results of our studies showed, the places of gadfly emergence are confined to overgrown banks of lakes, streams, channels, bogs, extensive swamps. This once again indicates the difficulty of identification and study of ecology of preimaginal phases of gadfly development.

In the floodplain of the Yertis River the main habitats of larvae of haemahydrobiont horseflies (genus Chrysops) are channels, river channels, floodplain lakes, ‘karasu’ (Table 2). There they are common and numerous.

Table 2 – Typisation of gadfly breeding sites in Pavlodar oblast

№ п/п	Types	Steppe lakes	Staritsa, channels of the Yertis River	Floodplain lakes, karasu, marshes from flood waters
1	*Chrysops relictus*	-	++	+
2	*Tabanus a. autumnalis*	+	+	++
3	*T. bovinus*	+	-	++
4	*Hybomitra nitidifrons confiformis*	-	-	++
5	*Haem. subcylindrica*	-	-	+
Note: ++ – common + – few in number				

Daily rhythm of gadfly activity. Features of landscape and faunistic complex, as well as climatic factors have a great influence on the activity of gadfly attack. Daily activity of gadfly attack in different climatic conditions manifests itself differently.

In the complex of environmental factors depressing years and daily activity, the first place is occupied by the influence of temperature and light intensity. Other ecoclimatic factors (wind, humidity, precipitation) are of secondary importance.

However, the activity of gadfly attack in specific conditions is determined by the totality of all these factors.

The data obtained by us on species composition, flight time and intensity of gadfly attack according to seasonal and daily course of mass species abundance can serve as ecological substantiation for the development of rational and effective measures to reduce their numbers.

Conclusion

In the north-east of Kazakhstan there are vast areas of characteristic habitats of horseflies. Detection of seasonal course of number, daily activity of gadfly attacks in local conditions, identification of places of gadfly larvae haul-out and accumulations is impossible without complete study of their biology and ecology.

The study showed that the fauna of blood-sucking insects in the north-east of Kazakhstan, in particular in Pavlodar region includes the following 5 genera: Chrysops, Atylotus, Tabanus, Hybomitra, Haematopota. Biological and ecological characteristics of horseflies, as well as their development depend on climatic conditions and are in close relationship with the presence of animals in the area.

Sanitary and preventive measures aimed at reducing and regulating their numbers are considered to be the main approaches in the fight against horseflies. The most widespread and effective method is the use of chemical preparations. An important aspect of this issue is the choice of not only the most effective preparations, but also environmentally safe means, as well as the definition and development of optimal methods and modes of their application, corresponding to the conditions of specific regions.

Treatments of animals with contact insecticides are considered environmentally safe and cost-effective, most of which, along with high insecticidal activity and low toxicity to warm-blooded animals, have a longer residual effect. It has been proved that the use of individual polymeric products impregnated with synthetic pyrethroids and their combinations in livestock farming may well replace permanent treatments with repellents and insecticidal solutions.

Conflict of interest

The authors declare no conflicts of interest.

References

1. Алдабергенов Н. К. Кровососущие двукрылые (Diptera: Fhlebotomidae, Culicidae, Simuliidae, Ceratopogonidae, Tabanidae) полуострова Мангышлак : автореф. … канд. биол. наук : 03.00.09. – Алма-Ата, 1975, – 28 с. https://search.rsl.ru/ru/record/01006904963

2. Енгашев С. В., Алиев М. А., Енгашева Е. С., Колесников В. И., Кошкина Н. А. Эффективность инсектицидно-репеллентного препарата ФЛАЙБЛОК® против двукрылых насекомых // Ветеринария. – 2019, – № 3, – С. 34-37. https://doi.org/10.30896/0042-4846.2019.22.3.34-37

3. Енгашев С.В., Кузьмина В.Б. Международный уровень фармацевтического производства лекарственных препаратов для ветеринарного применения – реальность // Технология чистоты. – 2020, – № 1, – С. 5-8. https://asincom-group.ru/zhurnali/tehnologiya-chistoty-1-2020/

4. Жанетов Б. Ж. Кровососущие двукрылые (Diptera : Culicidae, Simuliidae, Ceratopogonidae, Tabanidae) долины среднего и нижнего течения р. Урал и низовий р. Эмбы : автореф. … канд. биол. наук: 03.00.09. – Алма-Ата, 1975, – 28 с. https://search.rsl.ru/ru/record/01006928792

5. Исимбеков Ж. М. Биологические основы и система мероприятий против гнуса в животноводстве Восточного Казахстана: Автореф. … докт.биол.наук: 03.00.19. – Алма-Ата, 1994, – 35 с. https://elibrary.ru/ item.asp?id=30199054

6. Нурлина А. Б. Слепни (Diptera, Tabanidae) северо-востока Казахстана (фауна, экология и меры борьбы): автореф. … канд. биол. наук : 03.00.09. – Павлодар, 2009, – 120 с. https://e-catalog.nlb.by/vufind/Record/BY-NLB-br0000347625

7. Сивкова Е. И. Вредоносное воздействие слепней (Diptera, Tabanidae) на организм животных и человека (обзор) // Теория и практика борьбы с паразитарными болезнями. – М, 2019, – С. 575-579. https://doi.org/10.31016/978-5-9902340-8-6.2019.20.575-579

8. Скуловец М. В. Симулиидотоксикоз и демодекоз крупного рогатого скота: Дис. ... д-ра вет. наук: 03.00.19. – М., 2005, – 412 с. https://search.rsl.ru/ru/record/01002883321

9. Скуфьин К. В. Методы сбора и изучения слепней. – Л.: Наука, 1973, – Вып. 8, – 104 с. https://search.rsl.ru/ru/record/01007447419

10. Шевченко В. В. Аннотированный систематический каталог слепней Казахстана (Diptera, Tabanidae) // Тр. Ин-та зоол. АН КазССР. – 1985, – Т. 42, – С. 130-149.

11. Andrianov B. V. Bacterial symbionts and pathogens in populations of Phytoseiidae mites (Phytoseiidae, Mesostigmata) // Biology Bulletin Reviews. – 2023, – V. 12, – P. 578-584. https://doi.org/10.1134/S2079086422070027.

12. Fermino B. R., Paiva F., Viola B. L., Rodrigues M. C., Garcia A. H., Campaner M., Takata S. C., Sheferaw D., Kisakye J. J., Kato A., Jared A. C., Teixeira M. M., Camargo P. E. Shared species of crocodilian trypanosomes carried by tabanid flies in Africa and South America, including the description of a new species from caimans, Trypanosoma kaiowa n. sp. // Parasites Vectors. – 2019, – P. 1–17. https://doi.org/10.1186/s13071-019-3463-2

13. Krolow T. K., Henriques A. L. Checklist das espécies de mutucas (Diptera, Tabanidae) do estado do Mato Grosso do Sul, Brasil // Iheringia. Série Zoologia. – 2017, – P. 107. https://doi.org/10.1590/1678-4766e2017131

14. Krolow T. K., Lucas M., Henriques A. L. Revisiting the Tabanid Fauna (Diptera: Tabanidae) of Uruguay: Notes on the Species of the Genus Tabanus Linnaeus, with the Description of a New Species // Neotropical Entomology. – 2022, – P. 447-457. https://doi.org/10.1007/s13744-022-00958-7

15. Ma R., Li C., Tian H., Zhang Y., Feng X., Li J., Hu W. The current distribution of mites species in Inner Mongolia and inferring potential suitability areas for dominant mites species based on the MaxEnt model // Parasites & Vectors. – 2023, – V. 16, – № 1, – P. 286. https://doi.org/10.1186/s13071-023-05870-6.

16. Miraballes C., Aráoz V., Riet-Correa F. Rhipicephalus microplus, babesiosis and anaplasmosis in Uruguay: Current situation and control or elimination programs on farms // Experimental and Applied Acarology. – 2019, – 78(4), – P. 579-593 https://doi.org/10.1007/s10493-019-00405-0

17. Rodrigues G. D., Blodorn E., Zafalon-Silva A., Domingues W. B., Marques R., Krolow T. K., Greif G., Campos V. F., Kruger R. F. Molecular Detection of Trypanosoma kaiowa in Tabanus triangulum (Diptera: Tabanidae) from the Coastal Plain of Rio Grande do Sul, Southern Brazil // Acta Parasitoligica. – 2022, – P. 518–522. https://doi.org/10.1007/s11686-021-00440-1

18. Sivkova E. I., Domatskiy V. N. Influence of environmental factors on the fauna of the blood-sucking horseflies (Diptera, Tabanidae) // International Journal of Ecosystems and Ecology Science. – 2022, – V. 12 (4), – P. 251-258. https://doi.org/10.31407/ijees12.430

References

1. Aldabergenov N. K. (1975) Krovososushhie dvukrylye (Diptera: Fhlebotomidae, Culicidae, Simuliidae, Ceratopogonidae, Tabanidae) poluostrova Mangyshlak [Blood-sucking dipterans (Diptera : Fhlebotomidae, Culicidae, Simuliidae, Ceratopogonidae, Tabanidae) of the Mangyshlak Peninsula] : avtoref. … kand. biol. nauk : 03.00.09. Alma-Ata. – 28 s. https://search.rsl.ru/ru/record/01006904963. (in Russian).

2. Andrianov B. V. (2022) Bacterial symbionts and pathogens in populations of Phytoseiidae mites (Phytoseiidae, Mesostigmata) // Biology Bulletin Reviews. V. 12. – P. 578–584. https://doi.org/10.1134/S2079086422070027.

3. Engashev S. V., Kuz'mina V. B. (2020) Mezhdunarodnyj uroven' farmacevticheskogo proizvodstva lekarstvennyh preparatov dlja veterinarnogo primenenija – real'nost' [International level of pharmaceutical production of medicinal products for veterinary use – a reality]// Tehnologija chistoty. №1. – P. 5-8. https://asincom-group.ru/zhurnali/tehnologiya-chistoty-1-2020. (in Russian).

4. Engashev S. V., Aliev M.A., Engasheva E.S., Kolesnikov V.I., Koshkina N.A. (2019) Jeffektivnost' insekticidno-repellentnogo preparata FLAJBLOK® protiv dvukrylyh nasekomyh [Efficacy of the insecticide and repellent preparation FLYBLOCK® against two-winged insects]// Veterinarija. № 3. – P. 34-37. https://doi.org/10.30896/ 0042-4846.2019.22.3.34-37. (in Russian).

5. Fermino B. R., Paiva F., Viola B. L., Rodrigues M. C., Garcia A. H., Campaner M., Takata S. C., Sheferaw D., Kisakye J. J., Kato A., Jared A. C., Teixeira M. M., Camargo P. E. (2019) Shared species of crocodilian trypanosomes carried by tabanid flies in Africa and South America, including the description of a new species from caimans, Trypanosoma kaiowa n. sp.// Parasites Vectors. – P. 1–17. https://doi.org/10.1186/s13071-019-3463-2

6. Isimbekov Zh. M. (1994) Biologicheskie osnovy i sistema meroprijatij protiv gnusa v zhivotnovodstve Vostochnogo Kazahstana [Biological bases and system of measures against bites in livestock breeding in East Kazakhstan]: Avtoref. … dokt.biol.nauk : 03.00.19. – Alma-Ata. – 35 s. https://elibrary.ru/item.asp?id=30199054. (in Russian).

7. Krolow T. K., Henriques A. L. (2017) Checklist das espécies de mutucas (Diptera, Tabanidae) do estado do Mato Grosso do Sul, Brasil // Iheringia. Série Zoologia. – P. 107. https://doi.org/10.1590/1678-4766e2017131

8. Krolow T. K., Lucas M., Henriques A. L. (2022) Revisiting the tabanid fauna (Diptera: Tabanidae) of Uruguay: Notes on the species of the genus Tabanus Linnaeus, with the description of a new species// Neotropical Entomology. – P. 447-457. https://doi.org/10.1007/s13744-022-00958-7.

9. Ma R., Li C., Tian H., Zhang Y., Feng X., Li J., Hu W. (2023) The current distribution of mites species in Inner Mongolia and inferring potential suitability areas for dominant mites species based on the MaxEnt model // Parasites & Vectors. V. 16, № 1, – P. 286. https://doi.org/10.1186/s13071-023-05870-6.10.

10. Miraballes C., Aráoz V., Riet-Correa F. (2019) Rhipicephalus microplus, babesiosis and anaplasmosis in Uruguay: Current situation and control or elimination programs on farms // Experimental and Applied Acarology. 78(4), – P. 579-593 https://doi.org/10.1007/s10493-019-00405-0

11. Nurlina A. B. (2009) Slepni (Diptera, Tabanidae) severo-vostoka Kazahstana (fauna, jekologija i mery bor'by) [Blindflies (Diptera, Tabanidae) of north-eastern Kazakhstan (fauna, ecology and control measures)]: avtoref. … kand. biol. nauk : 03.00.09. Pavlodar. – 120 s. https://e-catalog.nlb.by/vufind/Record/BY-NLB-br0000347625. (in Russian).

12. Rodrigues G. D., Blodorn E., Zafalon-Silva A., Domingues W. B., Marques R., Krolow T. K., Greif G., Campos V. F., Kruger R. F. (2022) Molecular Detection of Trypanosoma kaiowa in Tabanus triangulum (Diptera: Tabanidae) from the Coastal Plain of Rio Grande do Sul, Southern Brazil// Acta Parasitol. 2022. – P. 518–522. https://doi.org/10.1007/s11686-021-00440-1

13. Shevchenko V. V. (1985) Annotirovannyj sistematicheskij katalog slepnej Kazahstana (Diptera, Tabanidae) [Annotated systematic catalogue of gadflies of Kazakhstan (Diptera, Tabanidae)] //Tr. In-ta zool. AN KazSSR. – Alma-Ata: Nauka. V. 42. – P. 130-149. (in Russian).

14. Sivkova E. I. (2019) Vredonosnoe vozdejstvie slepnej (Diptera, Tabanidae) na organizm zhivotnyh i cheloveka (obzor) [Harmful effects of horseflies (Diptera, Tabanidae) on animals and humans (review)] // Teorija i praktika bor'by s parazitarnymi boleznjami. – P. 575-579. https://doi.org/10.31016/978-5-9902340-8-6.2019.20.575-579. (in Russian).

15. Skuf'in K. V. (1973) Metody sbora i izuchenija slepnej [Methods of collecting and studying gadflies]. L.: Nauka, V. 8. – 104 p. https://search.rsl.ru/ru/record/01007447419. (in Russian).

16. Skulovec M. V. (2005) Simuliidotoksikoz i demodekoz krupnogo rogatogo skota [Simuliidotoxicosis and demodecosis of cattle]: Dis. ... d-ra vet. nauk: 03.00.19. M., – 412 p. https://search.rsl.ru/ru/record/01002883321. (in Russian).

17. Vasilevich F. I., Pigina S. Ju., Nikanorova A. M., Akbaev R. M. (2023) Metody sbora, hranenija i opredelenija krovososushhih nasekomyh i kleshhej: uchebnoe posobie [Methods of collection, storage and identification of blood-sucking insects and ticks: a training manual]. M. – 29 p. https://doi.org/10.18720/SPBPU/2/z23-6. (in Russian).

18. Zhanetov B. Zh. (1975). Krovososushhie dvukrylye (Diptera: Culicidae, Simuliidae, Ceratopogonidae, Tabanidae) doliny srednego i nizhnego techenija r. Ural i nizovij r. Jemby [Blood-sucking dipterans (Diptera: Culicidae, Simuliidae, Ceratopogonidae, Tabanidae) of the valley of the middle and lower reaches of the Ural River and the lower reaches of the Emba River]: avtoref. … kand. biol. nauk: 03.00.09. Alma-Ata. 28 p. https://search.rsl.ru/ru/record/01006928792. (in Russian).

Авторлар туралы мәлімет:

Калиева Айнагуль Балгауовна https://orcid.org/0000-0002-3210-1207 – биология ғылымдарының кандидаты, доцент, Торайғыров университетінің Биология және экология кафедрасының меңгерушісі, (Павлодар, Қазақстан, e-mail: ainanurlina80@mail.ru)

Чидунчи Ирина Юрьевна https://orcid.org/0000-0003-1885-9529 – PhD, Торайғыров университетінің Биология және экология кафедрасының қауымдастырылған профессоры, (Павлодар, Қазақстан, e-mail: chidunchi_irina@mail.ru)

Арынова Шынар Жаныбековна (сәйкес автор) http://orcid.org/0000-0002-9895-7649 – PhD, Торайғыров университетінің Биология және экология кафедрасының қауымдастырылған профессоры, (Павлодар, Қазақстан, e-mail: shinar_uzh@mail.ru)

Сергазинова Зарина Мухтаровна https://orcid.org/0000-0003-3437-8717 – PhD, Торайғыров университетінің Биология және экология кафедрасының қауымдастырылған профессоры, (Павлодар, Қазақстан, e-mail: wwwszm@mail.ru)

Корогод Наталья Петровна http://orcid.org/0000-0002-3211-2336 – биология ғылымдарының кандидаты, доцент, Маргулан университетінің жаратылыстану жоғары мектебінің доценті (Павлодар, Қазақстан, e-mail: natalya_korogod@mail.ru)

Information about authors:

Kaliyeva Ainagul Balgauovna https://orcid.org/0000-0002-3210-1207 – candidate of Biological Sciences, associated professor, Head of Department of Biology and Ecology, Toraighyrov University, (Pavlodar, Kazakhstan, e-mail: ainanurlina80@mail.ru)

Chidunchi Irina Yuryevna https://orcid.org/0000-0003-1885-9529 – PhD, associate Professor of Department of Biology and Ecology, Toraighyrov University, (Pavlodar, Kazakhstan, e-mail: chidunchi_irina@mail.ru)

Arynova Shynar Zhanybekovna (corresponding author) http://orcid.org/0000-0002-9895-7649 – PhD, associate Professor of Department of Biology and Ecology, Toraighyrov University, (Pavlodar, Kazakhstan, e-mail: shinar_uzh@mail.ru)

Sergazinova Zarina Mukhtarovna https://orcid.org/0000-0003-3437-8717 – PhD, associate Professor of Department of Biology and Ecology, Toraighyrov University, (Pavlodar, Kazakhstan, e-mail: wwwszm@mail.ru)

Korogod Natalya Petrovna http://orcid.org/0000-0002-3211-2336 – candidate of Biological Sciences, docent of the Higher School of Natural Sciences of Margulan university, Pavlodar, (Pavlodar, Kazakhstan, e-mail: natalya_korogod@mail.ru)

Поступила 3 октября 2024 года
Принята 10 марта 2025 года