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SPECIES DIVERSITY AND PREVALENCE OF ZOOPHILIC FLIES IN KOSTANAY REGION (NORTHERN KAZAKHSTAN)

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Abstract

This study delves into the understudied realm of zoophilic flies in the climatically distinct Kostanay region of Northern Kazakhstan. Amidst the region's diverse dipteran fauna, these parasitic flies pose a significant threat to both livestock and human health, acting as vectors for numerous infectious and invasive diseases.

This study aimed to elucidate the spatiotemporal dynamics of zoophilic *Diptera* in the Kostanay region during the summer of 2023.

As a result of the research, it was found that zoophilic flies of 8 families - representatives of 16 species - are registered on feedlots and pastures of farm animals of the Kostanay region of Northern Kazakhstan. Of these, the main species of flies (*Musca domestica, M. stabulans, Calliphora unralensis, C. vicina and Wohlfartia magnifica*) caused the greatest concern to animals. The total summer duration of zoophilic flies per season is 104-162 days or 3.5 - 5.5 months. Of the farm animals examined, cattle were the most intensively attacked.

Key words: distribution index; farm animals; flies; habitat; insects; species.

Introduction

Zoophilic flies pose a serious problem in animal husbandry, as they contribute to the transfer of various pathogens of infectious and invasive etiology, which affects the veterinary well-being of animal husbandry. The species composition of flies attacking animals is diverse and depends on the location of livestock facilities and pastures. There are over 100 species of these insects that come into contact with animals. Of these, 92 species are found in pastures and 57 in cowsheds [1].

Zoophilic flies in the environment of humans and animals are of no small importance. The harm caused by these diptera is due to their close trophic (primarily), topical and trophic relationships with domestic animals. Zoophilic flies cause significant economic damage, which consists of a decrease in the quantity and quality of livestock products (meat, milk, wool, etc.), spoilage and loss of feed, animal diseases with infectious and invasive diseases, and a decrease in the productivity of livestock workers. Young animals, which are more sensitive to these insects, suffer the most from the attack of flies [2].

Veterinary and medical significance the purpose of synanthropic flies, which are mechanical carriers of pathogens of many human and animal diseases, necessitates research to create effective and environmentally safe means of suppressing the number of parasitic insects [3, 4].

In the world's fauna, only the family of true flies (Muscidae) includes more than 100 genera. About 850 species from 52 genera and 5 subfamilies are known in the Palearctic. Houseflies are of great interest because some species contribute to the transfer of various bacteria and viruses [5].

Traditional methods of fly control include preventive and extermination measures. The essence of the first is to exclude potential fly breeding sites based on compliance with sanitary and hygienic requirements. The advantage of preventive measures is their environmental harmlessness, however, they are not able to provide a significant reduction in the number of flies. Only the destruction of flies by physical, chemical, biological methods and their combination gives a good result [6].

The housefly can carry pathogens of respiratory infections in cattle, which causes great damage to many livestock complexes [7].

Houseflies are a distributor of diseases such as dysentery, typhoid fever, tuberculosis, cholera. In addition to the housefly, the Muscidae family includes a large number of not only synanthropic species, but also those living outside settlements. In addition to the diseases listed above, real flies carry the polio virus, paratyphoid bacteria, tularemia, brucellosis, botulism, staphylococcal and micrococcal infections, as well as eggs of parasitic worms: ascariids, pinworms and lentipedes are most severely affected by fly attacks by young animals more sensitive to these insects. In addition, pathogenic and conditionally pathogenic microorganisms - *Salmonella, Escherichia, Pasteurella, spore bacteria*. The coccal group of microorganisms is represented by staphylococci and streptococci. Four species of fungi have been isolated from the outer integuments of flies, among which the genus Aspergillus prevails. Fungi are isolated mainly from adult insects [8].

The Kostanay region's diverse biogeographical landscape harbors a vast and understudied fauna of zoophilic flies, posing a potential public health risk due to zoonotic disease transmission. Zoophilic flies are sources of the spread of pathogens of many infectious and invasive diseases, and are also capable of causing independent diseases in the larval phase. The measures currently being carried out in livestock farms of the Kostanay region do not ensure a steady decrease in their numbers to a virtually harmless level. The epidemiological significance of flies and the real danger of their transferring pathogens of a number of dangerous human and animal diseases are the reasons for constant attention to this problem, the relevance of which is undoubted [9, 10].

The purpose of the study was to investigate the species diversity and prevalence of zoophilic flies in the Kostanay region, as well as to determine the duration of flight of zoophilic flies in places where animals are kept and grazed.

Materials and methods

Extensive ecological and faunal surveys were conducted across diverse livestock breeding landscapes within the Kostanay region, Kazakhstan, during May-October 2023. The expedition encompassed not only agricultural settings in the Denisov, Sarykol, Altynsarin, Auliekol, and Naurzum districts but also ecologically distinct habitats like the Karatamar and Verkhnetobol reservoirs and the Tobol and Ayat river floodplains.

Complementary laboratory analyses were conducted at the Department of Veterinary Medicine and the Museum of Entomology of the Faculty of Agricultural Sciences, Non-Profit Limited Company «Akhmet Baitursynuly Kostanay Regional University», Kostanay.

This comprehensive investigation aimed to gather robust insect material, quantify fly populations, and elucidate key aspects of zoophilic fly biology, including seasonal and diel activity patterns, reproductive strategies, and economic significance.

Observation sites for zoophilic flies were strategically established across livestock farms in the Kostanay region. These sites encompassed not only animal housing facilities (feedlots, summer camps) but also adjoining vegetated areas and designated grazing grounds. Species composition of flies was determined through a multi-pronged approach. First, clinical examinations of diverse livestock species (cattle, horses, sheep) within enclosures provided initial insights. Second, strategically placed spinning traps in animal keeping and grazing areas facilitated targeted fly collection. Finally, complementary sampling methods employing entomological nets and sticky paper ensured comprehensive capture, adhering to established protocols [6].

Extensive expeditionary, entomological, and laboratory investigations yielded a comprehensive collection exceeding 2,000 fly specimens. Species identification was meticulously conducted under the magnification of an MBS-10 microscope, utilizing established taxonomic keys and authoritative insect identification guides [7, 8].

Larvae and pupae were systematically collected from diverse substrates associated with animal activity and potential breeding grounds within animal housing and grazing areas.

Population density of parasite species (or groups) was assessed through the abundance index, defined as the average number of individuals encountered per recording unit. The primary method employed calculated the abundance index per host individual, encompassing both parasitized and non-parasitized objects within the study [9].

Data collection for this metric was rigorous, involving daily surveys at all livestock housing and grazing sites throughout the day, with a standardized 2-hour sampling interval.

Results

Analysis of fly assemblages across the study areas revealed remarkable taxonomic homogeneity. Both species composition and abundance demonstrated negligible variation, as detailed in the accompanying table. At the same time, a total of 16 species of zoophilic flies belonging to 8 genera were identified.

Table 1 - Species composition and abundance of flies collected in grazing areas

№	Name of the family	Quantity		Total flies collected	The dominance index, in %
		genus	view		
1	Syrphoidae	1	1	94	3,8
2	Sphaeroceridae	1	1	28	1,1
3	Otitidae	1	1	121	4,9
4	Anthomyiidae	1	1	154	6,2
5	Muscidae	1	5	1236	50,1
6	Fanniidae	1	1	102	4,1
7	Calliphoridae	1	3	572	23,2
8	Sarcophagidae	1	3	158	6,4
	ВСЕГО:	8	16	2465	100

Analysis of Table 1 reveals the dominance of two fly families in terms of species richness: Muscidae (5 species) and Calliphoridae (3 species). Notably, Muscidae exhibits a substantial dominance index (DI) of 50.1%, driven primarily by *Musca domestica* (DI 26.5%). *Muscina stabulans* emerges as the subdominant within Muscidae, contributing a DI of 3.6%. Calliphoridae follows in importance with an average DI of 23.2%.

Within the Calliphoridae, *Calliphora unralensis* emerged as the dominant species, contributing a 7.1% dominance index (DI), followed by the subdominant *C. vomitoria L* with a DI of 5.0%. Notably, across both animal housing and grazing sites, five zoophilic fly species consistently exhibited the highest abundance: *Musca domestica, Muscina stabulans, Calliphora unralensis, C. vicina,* and *Wohlfartia magnifica.* This consistent top five highlights the ecological resilience and adaptability of these specific zoophilic species within the studied livestock environments.

Quantitative assessment of zoophilic fly attacks on livestock revealed a distinct pattern. Cattle experienced the highest burden, with an average of 25.9 fly landings per animal (based on 10 individuals sampled). Horses and sheep followed with average attack rates of 9 and 8.8 flies per animal, respectively. Notably, Table 2 further details the flight initiation times of these harmful fly species under natural outdoor conditions, crucial for understanding their seasonal activity patterns. This distinction is important as dipterans typically exhibit activity indoors about a month earlier.

As such, Table 2 provides valuable insights into the timing of fly emergence and potential attack risk for livestock across different housing and grazing periods (Figure 1).

Table 2 – Duration of flight of zoophilic flies in places of keeping and grazing of animals

Species	Start of fly flight (date)	End of fly flight (date)	Duration of flight per season (days)
Musca domestica	19.04	29.09	162
Muscina stabulans	23.04	20.09	157
Fannia cannicularis	17.04	24.09	157
Lucilia sericata	04.06	14.09	104
Protophormia temenovae	14.04	03.10	158

Table 2 reveals a temporal sequence in the emergence of harmful zoophilic flies from wintering, ordered by their calendar dates of flight initiation. The earliest active flyers, observed on March 14th and 17th respectively, were *Protophormia terraenovae* and *Fannia cannicularis*. This vanguard is closely followed by *Musca domestica, Muscina stabulans,* and a second emergence of *Fannia canicularis*.

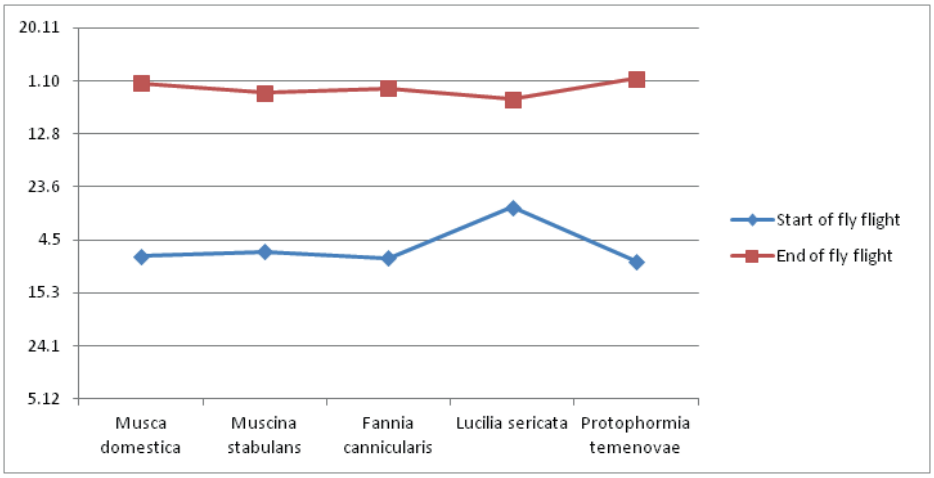

Figure 1 – The beginning and end of the summer of zoophilic flies in places where animals are kept and grazed

Discussion

Intriguingly, our observations reveal an unusually early emergence for the spring blue fly in 2023. Flight initiation commenced on March 14th, significantly preceding the typical second ten days of April. This early activity was followed by a prolonged flight period, extending until June 4th. While the main flight season for pasture flies typically concludes by September 20-30, a notable exception was observed. A small portion of populations, including field flies, *Protophormia,* and others, persisted at summer livestock camps, even overwintering in these locations. This phenomenon, in our view, suggests a potential adaptation for population resilience. By dispersing across different biotopes for wintering, these flies may mitigate the risks associated with unfavorable conditions in any single habitat, thus ensuring their overall survival.

Fly activity extended into early October, with the latest confirmed sightings of *M. domestica* (housefly), *Protophormia spp.*, and *C. vicina* occurring on October 3rd, 2023. This late persistence coincided with air temperatures ranging from 3-5 °C in the shade to 12-14 °C in direct sunlight, demonstrating remarkable adaptability in these species. Notably, cattle experienced the highest burden of fly attacks, with an average of 25.9 landings per individual (n=10). Horse and sheep attack rates followed at 9.4 and 8.8 landings per animal, respectively, suggesting potential species-specific preferences or varying susceptibility among livestock.

Conclusion

Extensive ecological and faunal surveys across diverse livestock facilities in Northern Kazakhstan's Kostanay region, encompassing districts (Denisov, Sarykol, Altynsarin, Auliekol, Naurzum), water reservoirs (Karatamar, Verkhnetobol), and river floodplains (Tobol, Ayat), revealed a rich assemblage of zoophilic flies. A total of 16 species representing 8 families were documented on animal feedlots and pastures. Notably, five dominant species (*Musca domestica, M. stabulans, Calliphora unralensis, C. vicina,* and *Wohlfartia magnifica*) comprised 87.8% of all collected flies, posing the greatest concern to livestock. These species exhibited extended flight seasons, ranging from 104 to 162 days (3.5-5.5 months), highlighting their ecological resilience and potential pest pressure. Interestingly, cattle emerged as the most heavily attacked livestock species among the three studied (cattle, horses, sheep), suggesting potential variations in fly preferences or host susceptibility.

References

1 Kosminkov, N.E. Parasitology and parasitic diseases of farm animals [Text]: N.E. Kosminkov, B.K. Laipanov, V.N. Domatsky // - M.: "INFRA-M". 2019. - 467 p.

2 Domatsky, V.N. Distribution and management of the zoophilous flies [Text] / V.N. Domatsky, E.I. Sivkova. // Ukrainian Journal of Ecology. - 2021. - No. 11 (9). - P. 88-94. doi: 10.15421/2021_300.

3 Egorov, S.V., Experience in combating zoophilic flies in cattle breeding farms of the Ivanovo region [Text] / S.V. Egorov, E.N. Kryuchkova, E.A. Sokolov // "Theory and practice of combating parasitic diseases": materials of reports of the International Scientific Conference of the All-Russian Society of Helminthologists of the Russian Academy of Sciences. M., - 2021. Issue. 22. - P. 176-181.

4 Engashev, S.V. Efficiency of the insecticidal-repellent preparation FLYBLOCK® against dipteran insects [Text] / S.V. Yengashev, M.A. Aliev, E.S. Engasheva, V.I. Kolesnikov, N.A. Koshkina // Veterinary medicine. - 2019. - No. 3. - P. 34-37.

5 Tashbulatov, A. A. A new approach to the control of flies in poultry farms [Text] / A. A. Tashbulatov // Veterinary Medicine. - 2017. - No. 1 - P. 42-44.

6 Sivkova E.I. Some data on zoophilic flies of Siberia and the Russian Far East// Ukrainian Journal of Ecology. - 2021. - No.11(6). - P. 100-104.

7 Pereira, L.A. Larvicidal and adulticidal effects and ultrastructural changes of larvae midgut epithelium of Musca domestica (Diptera: Muscidae) fed with Bacillus thuringiensis [Text] / Pestic Biochem Physiol, - 2019. - No.72(1). - P.40-44.

8 Shchipacheva, L. P. Species composition and bacterial contamination of zoophilic flies in meat processing plants [Text]: L. P. Shchipacheva, A. K. Metelitsa // Problems of entomology and arachnology: A collection of scientific papers. – Tyumen: "Risograph" of The Tyumen Agrarian Academic Union, - EDN UGYLBR. 2002. - 192-194 p.

9 Adler, P.H., Crosskey, R. W. World black flies (Diptera: Simuliidae): a fully revised edition of the taxonomic and geographical inventory [Text] / London: The Natural History Museum, 2018. -P. 134.

10 Engashev, S.V., Kuzmina, V.B. The international level of pharmaceutical production of drugs for veterinary use is a reality [Text] / Technology of purity. - 2020. - No. 1. - P.5-8.

References

1 Kosminkov, N.E., Laipanov, B.K., Domatsky, V.N. (2019). Parasitology and parasitic diseases of farm animals. INFRA-M. 467.

2 Domatsky, V.N., Sivkova, E.I. (2021). Distribution and management of the zoophilous flies. *Ukrainian Journal of Ecology*. 11(9), 88-94. doi: 10.15421/2021_300.

3 Egorov, S., Kryuchkova, E., Sokolov, E. (2021). Experience in combating zoophilic flies in cattle breeding farms of the Ivanovo region. "Theory and practice of combating parasitic diseases": materials of reports of the International Scientific Conference of the All-Russian Society of Helminthologists of the Russian Academy of Sciences. 22, 176-181.

4 Engashev, S., Aliev, M., Engasheva, E., Kolesnikov, V., Koshkina, N. (2019). Efficiency of the insecticidal-repellent preparation FLYBLOCK® against dipteran insects. *Veterinary medicine*, 3, 34-37.

5 Tashbulatov, A. (2017). A new approach to the control of flies in poultry farms. *Veterinary Medicine,* 1, 42-44.

6 Sivkova, E.I. (2021). Some data on zoophilic flies of Siberia and the Russian Far East. *Ukrainian Journal of Ecology,* 11(6), 100-104.

7 Pereira, L.A. (2021). Larvicidal and adulticidal effects and ultrastructural changes of larvae midgut epithelium of Musca domestica (Diptera: Muscidae) fed with Bacillus thuringiensis. *Pestic Biochem Physiol,* 72(1), 40-44.

8 Shchipacheva, L.P., Metelitsa, A.K. (2020). Species composition and bacterial contamination of zoophilic flies in meat processing plants. *Problems of entomology and arachnology: A collection of scientific papers. Tyumen: "Risograph" of The Tyumen Agrarian Academic Union,* 192-194.

9 Adler, P. Crosskey, R. (2018). World black flies (Diptera: Simuliidae): a fully revised edition of the taxonomic and geographical inventory. *The Natural History Museum*, 134.

10 Engashev, S., Kuzmina, V. (2020). The international level of pharmaceutical production of drugs for veterinary use is a reality. *Technology of purity,* 1, 5-8.