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UDC 619. 591.69.616.99 **Research article**

On the distribution of botfly diseases of horses and camels in the Atyrau and Kyzylorda regions of the Republic of Kazakhstan

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Abstract

Background and Aim. Botfly larvae parasitize horses and camels, adversely affects animal health and productivity, and can cause death. This raises a need for systematic control of some botfly species. Botfly parasitism causes significant economic damage in Western Kazakhstan, where camel and horse breeding are prominent.

Materials and Methods. The study covered the Kazaly and Aral districts (Kyzylorda region), and the Makhambet, Isatay, Kurmangazy districts (Atyrau region). Field research was conducted in the Kyzylorda region in May and September, 2024, and in the Atyrau region in June, July and September. During the study, a total of 25 camels and 23 horses were examined in the Kyzylorda region; 41 camels and 37 horses were examined in the Atyrau region. The ante-mortem diagnoses of camel *cephalopinosis* and horse *rhinoestrosis* were established endoscopically.

Results. Botfly larvae were found in the nasal passages of the examined camels and horses and in the stomachs of the horses. In the Kyzylorda region, no *cephalopinosis* cases were detected among camels in the spring; however, the prevalence increased to 36% in the autumn. In the Atyrau region, there were no cases of *cephalopinosis* in July, but its prevalence rose to 17.1% in the autumn.

No *rhinoestrosis* cases were detected in the Kyzylorda region. In the Atyrau region, there were no occurrences of the disease in June; however, 9.5% of horses already had *rhinoestrosis* in September.

The prevalence of *gasterophilosis* among horses of the Kyzylorda region remained at 33.3% in the spring and autumn. In the Atyrau region, the prevalence of *gasterophilosis* was 20% in the spring, rising to 100% in the autumn.

Conclusion. *Cephalopina titillator* larvae were found in camels in September. Rhinoestrus sp. larvae were detected in horses in September, while *Gasterophilus intestinalis* was observed in May, June and September. Adult botflies were active in September.

Keywords: botflies; parasites; *Equidae; Camelidae; gasterophilosis; cephalopinosis; rhinoestrosis.*

Introduction

Parasitic infections caused by botflies hinder the development of livestock production in the Republic of Kazakhstan and remain a serious concern. Despite all efforts, new cases of botfly infections among livestock are reported every year in many countries, including those that share a border with Kazakhstan and those that are geographically distant. This causes substantial economic damage to the agricultural sector [1, 2].

As long as there is a persisting threat to the biosecurity of the country and complete eradication of parasitic infections is not achieved, it is crucial to develop innovative methods for the identification of invasive pathogens, study their biological and phenological development in different regions and climate zones, and elaborate effective measures of prevention and control.

The most common parasitic infections affecting large livestock are *rhinoestrosis* and *gasterophilosis* of horses and *cephalopinosis* of camels [3-7].

Botflies belong to the infraorder Muscomorpha within the order Diptera. According to the literature, there are 30 genera and 176 species of botflies [8]. Most of these parasites are associated with mammals. There are 3 major botfly families: *Hypodermatidae, Gasterophilidae* and *Oestridae.* The larvae of *Hypodermatidae* infest the subcutaneous tissue of rodents, lagomorphs and ungulates; *Gasterophilidae* inhabit the digestive tract of equids and rhinoceroses. *Oestridae* infest the upper respiratory tract and frontal sinuses of even-toed and odd-toed ungulates. Botfly myiasis can occasionally occur in livestock handlers [9]. All of the three botfly families are common in Kazakhstan, where livestock production is historically widespread and farming is currently on the rise; they pose a significant problem to the industry that needs to be addressed comprehensively to improve the existing measures of prevention and control. Considering that botfly populations can increase rapidly under conducive conditions, e.g. favorable weather and climate or the absence of preventive livestock treatments, complete eradication of livestock diseases caused by botflies is not feasible. However, timely prevention, including treatments of the farm premises with insecticides, body checks etc., can significantly reduce the parasitic burden in domesticated animals.

Cephalopinosis is a parasitic disease of camels caused by *Cephalopina titillator* (*Clark*, 1816) from the *Oestrinae* subfamily of *Oestridae*. Its larvae infest the nasal cavity, nasopharynx, ethmoidal labyrinths, and laryngeal walls. The infestation presents as rhinitis and laryngotracheitis. The products of *C. titillator* larvae metabolism and secondary infections often exacerbate the condition of the affected animals; in severe cases, asphyxiation and death can ensue [10]. Studies have confirmed the high prevalence of this infection among camels across Asia, highlighting the importance of its prevention and control for modern camel breeding [11, 12]. The disease is most frequently reported in CIS countries, China, and Iraq [13, 14, 15].

Rhinoestrosis is a chronic disease of horses caused by the invasion of nasopharyngeal botfly larvae into the nasal cavity and the adjacent structures. The causative agents of *rhinoestrosis* are 3 species of the nasopharyngeal botflies from the genus *Rhinoestrus* that represent the *Oestrinae* subfamily of *Oestridae: Rh. purpureus, Rh. latifrons* and *Rh. usbekistanicus.* The larvae migrate to the ethmoidal labyrinths and frontal sinuses, feeding on the inflammatory products of the mucous membranes [10].

Horses infested with *Rhinoestrus spp.* suffer from persistent rhinitis; their nasal discharge often contains traces of blood. The nasal mucosa appears scarred and ulcerated. The animals look emaciated, have labored breathing, develop a neurological disorder and can die in severe cases. Necropsy typically reveals mucosal ulceration and redness at the affected sites, with pus buildup and larvae deposits at the lesion's base [16, 17].

Gastrophilosis is a parasitic disease of equids (*Equidae*) caused by the larvae of stomach botflies (*Gastrophilidae*). It typically occurs during the summer grazing period when botflies are active. Coinfection caused by other species of this parasite is common in horses (*Equus ferus caballus*) and donkeys (*Equus asinus*). After a three-week developmental period in the mouth, bot fly larvae migrate and attach themselves to the mucus lining of the horse's stomach and remain there during the winter. After about 10 months, they detach from the lining and are passed out of the body through the feces. The larvae burrow into the ground and mature. Depending on the conditions, adults emerge in three to 10 weeks. Adult females deposit eggs on the horse's legs, shoulders, chin, throat and lips. Depending on geographic location, the life cycle of bot flies is not fixed to only certain times of the year, and bot larvae can be active in horses in warm periods of the year.

In severe cases, infestation disrupts the motor and secretory functions of the equine gastrointestinal tract. Damage to the oral cavity is also common: the larvae feed on the oral mucosa and submucosa, which leads to the ulceration of the inner cheek, soft palate, and tongue. Infestation of the stomach and the duodenum causes tissue damage, swelling and mucosal inflammation, which may lead to stomach or intestinal wall rupture. The products of larval metabolism enter the bloodstream, causing intoxication,

weakness and digestive tract disorders. The causative agents of gastrophilosis are *Gastrophilus intestinalis, G. veterinus, G. haemorhoidalis, G. pecorum, G. inermis, G. nigricornis, G. magnicornis,* and *G. flavipes,* which mainly parasitizes donkeys [18].

In Eurasia, the greatest diversity of *Gasterophilus* species is observed in China, where seven species are known. Among them, G. pecorum is the most common, followed by *G. noselis, G. nigricornis, G. intestinalis, G. haemorrhoidalis,* and *G. inermis* [19]. The most common *Gasterophilus* species that parasitizes horses is *G. intestinalis* [20].

The zone of greatest distribution of camels and horses in Kazakhstan is Mangystau, Turkistan, Kyzylorda and Atyrau regions. According to the data for 2024, the largest number of camels inhabits Atyrau and Kyzylorda regions. After the dissolution of the Soviet Union, the first study of botfly myiases in Central Asia was conducted by *B.Ibraev* et al. in Kazakhstan; he reported the high prevalence of *G. intestinalis, G. nasalis* and *G. pecorum i*n the northern and central parts of the country, in Kostanay, Akmola and Karagandy regions. Their bots cause a variety of pathologic conditions in horses, including gastritis and digestive disorders [21]. *G. inermis, G. intestinalis* and *G. noselis* have been reported in Iran [22]; *G. intestinalis, G. haemorrhoidalis* and *G. noselis* occur in Turkey [23]. In other Asian countries, the diversity of botfly species is lower. So far, only *G. intestinalis* and *G. noselis* have been reported in Belarus [24] and *G. intestinalis* in Yakutia [25]. In light of the above, in the western regions of Kazakhstan, where infestations by botflies inflicts significant damage to camel and horse breeding, there is an urgent need to develop a scientifically grounded system of measures to control botflies. To prevent the substantial economic losses they cause, it is essential to determine the species composition of botflies in the studied region. The aim of our research is to investigate the biological and ecological characteristics of botflies whose larvae cause infestations in camels and horses in the Atyrau and Kyzylorda regions.

Materials and Methods

Ethical approvals

The study was conducted with written consent from the animal owners, in accordance with local regulations for the keeping of farm animals. All procedures complied with EU Directive 2010/63/EU on animal experimentation. Protocols of parasitological research design and standard operating procedures were approved by the Bioethics Commission of "Kazakh Scientific Research Veterinary Institute" LLP (conclusion dated 30.01.2021).

The study was conducted in the Aral and Kazaly districts of the Kyzylorda region in May through September, 2024, and in the Makhambet, Kurmangazy and Isatay districts of the Atyrau region in June and July, 2024. A total of 48 animals (25 camels and 23 horses) from 5 livestock farms of the Kyzylorda region and 78 animals (41 camels and 37 horses) from the Atyrau region were examined. The presence of botfly larvae was determined by the visual examination of the head, nodules, nose, nasal passages); prior to the examination, the animals were immobilized. Subsequently, the frequency index of the infection (percentage of the infected animals) and its abundance index (the average number of larvae per host) were calculated. The nasopharynx and the gastrointestinal tract were examined using an endoscopy system with a real-time video camera. The acquired image was displayed on the screen of a mobile phone with an installed Endoscope Finder application.

When examining the nasal passages of live animals using an endoscope, it was not possible to accurately count the number of detected larvae.

Adult botflies flying near the animals were collected for further analysis using a sweep net.

The collected adult botflies were placed in a killing jar containing a cotton pad soaked with ethyl acetate [26].

The presence of *Gastrophilus* was assessed by the physical examination of the animals, including their coat and skin. Egg clusters were collected by clipping horse hairs with the attached eggs.

To assess the severity of botfly infestation, horse stomachs were collected at the Atyrau Et Ortalygy slaughterhouse of Atyrau, the Kurmangazy service and procurement center in the village of Zhumeken (the Kurmangazy district), a slaughterhouse in the Makhambet district, and a meat processing plant in Aral city. Additionally, the mucosa of the nasal cavities and frontal sinuses was examined for the presence of botfly larvae (Figure 1 D). Specimens collected from each animal were placed in separate screw-cap tubes, labeled and stored in special containers until further transportation to the laboratory.

GPS coordinates of the collection sites were recorded using GPS navigators; GIS maps were created using the ArcMap software [28]. All collected specimens of eggs, larvae, pupae, and adult botflies were studied in the laboratory. Species of the collected botflies were identified using identification keys [9, 10, 18, 27]. Species identification was conducted using a stereomicroscope at the Parasitology Laboratory of "Kazakh Scientific Research Veterinary Institute" LLP.

Results and Discussion

Camels and horses of the Kyzylorda and Atyrau regions have been examined for the infestation of botfly larvae (Figure 1).

Figure 1 – Map showing examination and sampling locations in the Atyrau and Kyzylorda regions

Cephalopinosis. Ten camels were examined for cephalopinosis in the Aral and Kazaly districts of the Kyzylorda region in the second half of May; no botfly larvae were detected in the examined animals (Table 1).

Table 1 – Results of ante-mortem examination of camels for the presence of botfly larvae in the Atyrau and Kyzylorda regions

Study area	Month of research	Number of examined animals	Number of infested animals	Occurrence index, %	Type of parasite
Kyzylorda region	May	10	-	-	-
	September	15	9	60	*C. titillator*
Total		25	9	36	
Atyrau region	June- July	25	-	-	-
	September	16	7	43.75	*C. titillator*
Total		41	7	17.07	

In the second half of September, another 10 camels were examined. The live larvae of *C. titillator* were detected endoscopically in 4 camels in the village of Bogen in the Aral district; the prevalence index was 40% (Figure 2A). Another 5 *C. titillator* larvae were detected in 5 camels in the Kazaly district and the Zholdybai area of the Kumzhiek rural district; the prevalence index was 100% (Figure 2B).

In the Atyrau region, animal body checks were conducted in the Makhambet, Kurmangazy, and Isatay districts of the Atyrau region in the third decade of June and the first decade of July; no signs of botfly infestation were observed. In the first and second decades of September, 5 camels were examined. During the endoscopic examination, live larvae of *C. titillator* were detected in one animal (prevalence

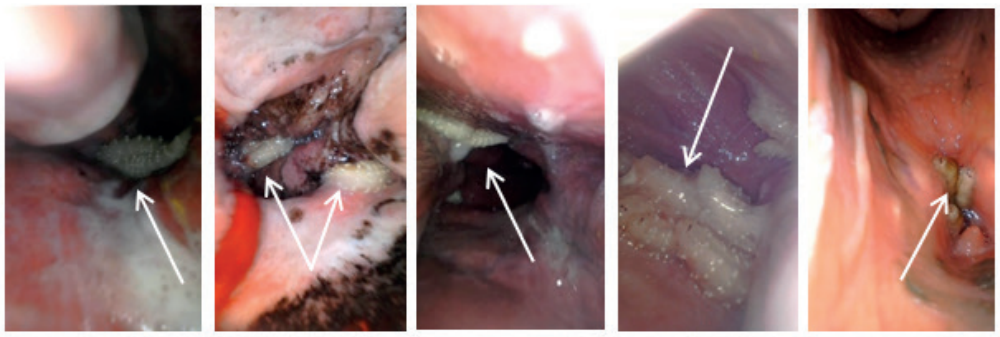
index: 20%) in the Zhanbay village of the Isatay district (Figure 2C). In the Zhylandy village of the Kurmangazy district, *C. titillator* larvae were found in 6 out of 11 examined camels (prevalence index: 54.5%) (Figure 2 D).

Rhinoestrosis. Ten horses were examined endoscopically for rhinoestrosis in the Aral and Kazaly districts of the Kyzylorda region in the second half of May; another 4 horses were examined in the second half of September. No botfly larvae were detected (Table 2).

Table 2 – Results of ante-mortem examination of horses for the presence of botfly larvae in Atyrau and Kyzylorda regions

Study area	Month of research	Number of examined animals	Number of infested animals	Occurrence index, %	Type of parasite
Kyzylorda region	May	10	-	-	-
	September	4	-	-	-
Total		14	-	-	-
Atyrau region	June- July	2	-		*Rhinoestrosis sp.*
	September	19	2		*Rhinoestrosis sp.*
Total		21	2	9,5	*Rhinoestrosis sp.*

Between the first decade of June and the second decade of July, 2 horses were examined for rhinoestrosis in the Atyrau region. In the first half of September, 5 horses were examined endoscopically at the meat processing plant in the city of Atyrau. No botfly larvae were detected in the nasal passages of the animals. In the Zhylandy village of the Kurmangazy district, 14 horses were examined for rhinoestrosis; live *Rhinoestrosis sp.* larvae were found in 2 animals (prevalence index: 14.3%) (Figure 2 E).



A-D – *C. titillator* larvae in the nasal passages of camels,
E – *C. titillator* larvae in the nasal passages of horses
Figure 2 – Nasopharyngeal botfly larvae in the nasal passages of camels and horses

Gastrophilosis. Examinations were conducted in the Aral and Kazaly districts of the Kyzylorda region and in the Isatay, Kurmangazy, and Makhambet districts of the Atyrau region.

Table 3 – Results of post-mortem examination of horses for the presence of botfly larvae in Atyrau and Kyzylorda regions

Study area	Month of research	Number of examined animals	Number of infested animals	Occurrence index, %	Abundance index, spec.	Type of parasite
Kyzylorda region	May	6	2	33.3	778	*Gastrophilus sp.*
	September	3	1	33.3	253	*Gastrophilus sp.*
Total		9	3	33,3	1031	*Gastrophilus sp.*

Continuation of table 3

Atyrau region	June- July	10	2	20	1780	*Gastrophilus sp.*
	September	6	6	100	367	*Gastrophilus sp.*
Total		16	8	50	2147	*Gastrophilus sp.*

In the second half of May, 5 horses were examined in the Aral and Kazaly districts of the Kyzylorda region. Sixteen specimens of third-instar larvae of *Gastrophilus sp.* were found in the pharynx of one horse. Thus, the intensity index was 3.2, and prevalence index was 20%.

To assess the potential degree of infestation in the areas included in the study, horse stomachs were collected at the meat processing plant of Aral city. A total of 762 specimens of *Gastrophilus sp. l*arvae were collected from the stomach of one horse. This suggests that infestation by botfly larvae might be quite significant in some areas. In the second half of September, two horses were examined; no bots were found in their pharynx. However, during the dissection of a horse's stomach at the Aral meat processing plant, 253 gastric botfly larvae were detected.

In the Atyrau region, 10 horses were examined at the Makhambet slaughterhouse starting from the first decade of June to the second decade of July. Infestation with *Gastrophilus sp.* was detected in 2 horses. A total of 1,708 2nd and 3rd instar larvae were collected (Figure 3). The intensity index was 178 specimens, and the prevalence index was 20%. In the first half of September, 5 horses were examined at the meat processing plant of Atyrau city. In all examined stomachs of 5 horses, 311 larvae of *Gastrophilus sp*. were found, with an AI of 62.2 specimens. The stomach of another horse transported to the Kurmangazy slaughter from the Zhumeken village of the Kurmangazy district in the second half of September contained 56 Gastrophilus larvae.

A B

A – before larvae removal, B – after larvae removal

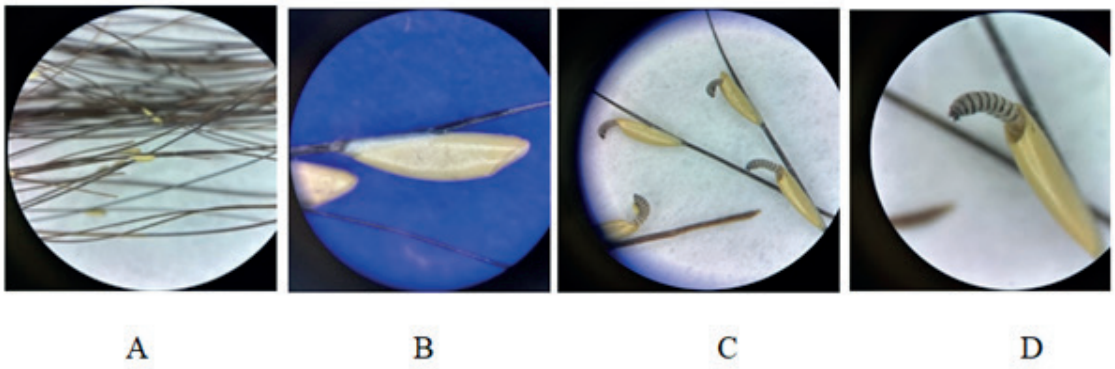
Figure 3 – Infestation of a horse stomach by *Gastrophilus sp.* Larvae

In September, we observed congregates of botflies around horse pastures. Female botflies oviposit eggs in the mane, on the medial surface of forelegs, the chest, and the flanks. Twelve adult botflies were collected in the village of Zhanbay in the Isatay district using a sweep net, and another two were collected in the village of Aktogay (the Moinak area) in the Makhambet district.

In the Kazaly district, Kumzhiek, Zholdybai area, 1 botfly was collected. The collection procedure was carried out near the head, neck, and back of the horse, i.e. areas most susceptible to botfly attacks. The number of eggs per horse exceeded 300. The eggs were found in the horse mane, groin, on the shoulders and legs (Figure 4).

Figure 4 – Sites of *Gasterophilus intestinalis e*gg deposits in horses

The eggs were light and yellowish. They were wedge-shaped, wider at the apex, tapering toward the base, 1.27 mm in length. The attachment region extended only slightly beyond the midpoint of the egg. The operculum was rounded and egg-shaped (Figure 5 A, B). The eggs were kept in the laboratory at room temperature; 20-25 days later, they hatched into first-instar larvae measuring 1.05 to 1.10 mm in length (Figure 5 C, D). In the eggs collected after a drop in air temperature, the larvae were dead.



A, B – eggs; C, D – first-instar larvae

Figure 5 – *Gasterophilus intestinalis* eggs and larvae under microscope

Identification of adult flies and parasitic larvae was conducted in the laboratory using stereoscopic microscopy based on morphological characteristics, with the aid of identification keys. We examined 3,106 larvae and 15 adult specimens.

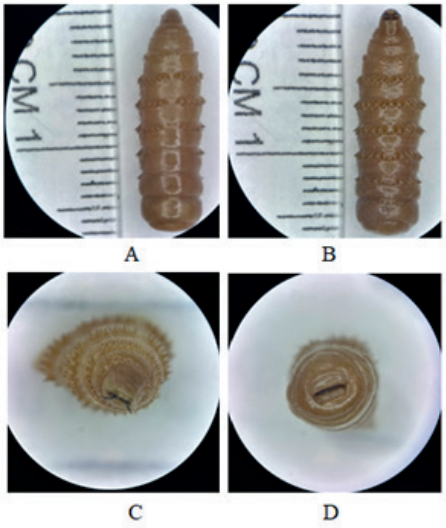
All larvae extracted from the stomachs of horses had a bullet-shaped body, with a pointed anterior end and a broad posterior end, measuring 16-17 mm in length. Unlike larvae of other botflies from the family Hypodermatidae, the larvae we found (2nd and 3rd instars) possessed mouth hooks (Figure 6 B, C). Additionally, in contrast to larvae of the family Oestridae, there was a well-developed median spine between the mouth hooks.

In *Gasterophilus intestinalis* larvae parasitizing horses, two rows of small, forward-pointing hooks are present beneath the sensory organ in the pseudocephalon (Figure 6). Second- and third-instar larvae

typically attach to the non-glandular part of the stomach mucosa, near the junction with the esophagus. These larvae remain immobile for 9-12 months.

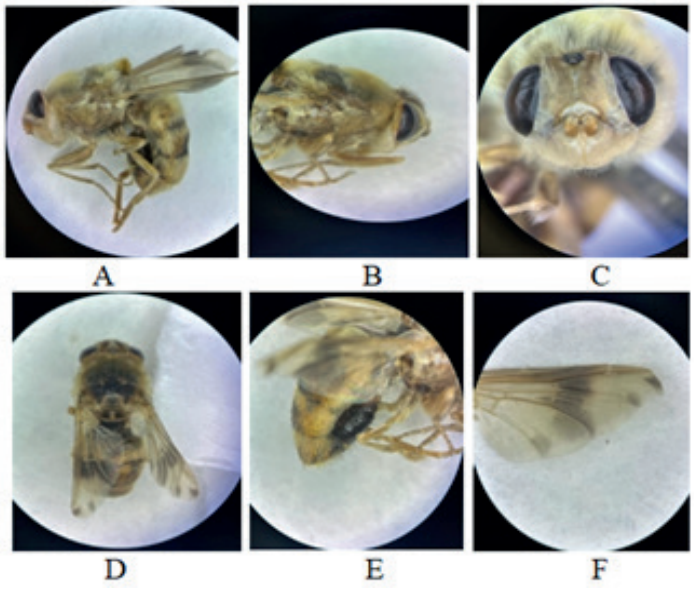
Third-instar larvae are relatively large, ranging from 12.7 to 19.1 mm in length. Both larval stages are adapted to life in the gastrointestinal tract due to their rounded body shape, narrow hook-like mouthparts, and spines – key distinguishing features of *Gasterophilus intestinalis* compared to other botfly larvae of the same genus [9]. Third-instar larvae are characterized by a yellowish coloration.

Based on the combination of these morphological traits, all examined larvae were identified as *Gasterophilus intestinalis* (*De Geer,* 1776) (commonly known as the horse botfly or large stomach botfly).



A – ventral view, B – dorsal view, C – cranial view, D – caudal view
Figure 6 – Second-instar larvae of *G. intestinalis*

All of the 15 collected specimens of botflies belonged to *Gasterophilus intestinalis* (*De Geer*, 1771) (large stomach botfly or horse botfly) (Figure 7). The adult fly typically measures 12 to 15 mm in length, is yellowish-brown, and does not have pronounced sexual dimorphism. It has 9 to 11 mm spotted wings. The botfly has small, non-functional mouthparts. A female's abdomen is elongated with a long ovipositor underneath.



A – habitus, left lateral view, B – head and thorax, C – head, frontal view,
D – habitus, dorsal view, E – abdomen, F – wing
Figure 7 – Female *Gasterophilus intestinalis* under the microscope

Summing up the results, infestation of horses with *Gasterophilus intestinalis* in the Atyrau region occurs not only in autumn but also in spring and summer. In autumn, it begins in the second or third decade of August and the first or second decade of September; it ends by November, or, if the weather is dry and warm, in the first decade of November.

Statistical Analysis of Botfly Larvae Infestation in Camels and Horses Across Atyrau and Kyzylorda Regions. To assess statistically significant differences in botfly larvae infestation rates among camels and horses between Atyrau and Kyzylorda regions, Pearson's chi-square (χ^2) test was employed. The analysis was performed separately for three datasets: clinical examination of camels, clinical examination of horses, and postmortem examination of horses. A two-tailed test was used, with the significance threshold set at $\alpha = 0.05$.

In the first group (camels, clinical examination), 66 animals were examined. Infestation was detected in 9 of 25 animals (36%) in Kyzylorda region and 7 of 41 (17.07%) in Atyrau region. The χ^2 test revealed no statistically significant interregional difference ($\chi^2 = 2.09$; $P = 0.149$), despite the apparent disparity in prevalence.

In the second group (horses, clinical examination), infestation was documented exclusively in Atyrau region (2 cases among 21 animals), with no infected animals detected in Kyzylorda region (0 of 14). The χ^2 value of 0.20 ($P = 0.656$) likewise indicated no significant regional variation.

The third group (horses, postmortem examination) showed infestations in both regions: Kyzylorda (3 of 9 cases) and Atyrau (8 of 16). Here too, the χ^2 test found no statistically significant difference ($\chi^2 = 0.15$; $P = 0.699$).

A supplementary case-control analysis was conducted, treating infestation status as a binary dependent variable and region as an independent factor. For camels, the odds ratio (OR) was 1.53 (95% confidence interval [CI]: 0.61–3.82; $P = 0.364$). While statistically non-significant, this suggests a potential epizootiological trend warranting investigation with larger samples.

The analysis identified no statistically significant interregional differences in infestation rates. However, the observed prevalence values merit attention within epizootiological surveillance frameworks. Future studies will incorporate expanded sample sizes, seasonal stratification, and additional risk factors to refine epidemiological understanding and enhance prevention strategies.

Conclusion

Botfly myiasis of horses and camels has been detected in the Aral and Kazaly districts of the Kyzylorda region and the Isatay, Makhambet, and Kurmangazy districts of the Atyrau region.

In the autumn, the prevalence of cephalopinosis in camels was 36% in the Kyzylorda region and slightly lower (17.1%) in the Atyrau region.

In the Atyrau region, 9.5% of *rhinoestrosis* cases among horses occurred in the autumn.

In the spring, the prevalence of *gastrophilosis* in horses in the Kyzylorda region was 33.3%. In the Atyrau region, it reached 50%.

The high level of botfly infestation in autumn may be associated with free-range intensive grazing, which contributes to the spread of the parasite. These assumptions are based on the high intensity of infestation in individual animals and their overall body condition. It is known that in severe cases of botfly myiasis, animals may stop eating and lose weight. We think that the acquired data does not reflect the full picture of the parasitic burden caused by botflies in camels and horses. Obviously, more animals should be examined, but there are obstacles. First, livestock owners often frown upon the idea of capturing and immobilizing their animals. Second, most of the farm animals graze on free-range pastures, where botfly infestation occurs in the first place. This is indirectly confirmed by our failure to find botfly pupae in the potential pupation substrates on farm premises. In other words, if livestock spent most of their time in enclosures, mature botfly larvae would get into the substrate, where they would be easier to detect than in the open desert or steppe.

Furthermore, the presence of other dipterans, especially flies (*Muscidae*), collected near and from the animals, poses an additional risk of infestation and is an annoyance for the animals. Infestation and fresh lesions induced by the larvae attract other insects, promoting secondary contamination. We think that livestock infestation with botfly larvae can be prevented by 1) treating the skin with chemical or biological insecticides that are non-toxic to animals and humans; 2) applying repellents to coat and skin

to deter adult botflies; 3) conducting regular disinsection procedures in enclosures and farmyards and using pheromone traps for adult botflies.

Summing up, research conducted in the Atyrau and Kyzylorda regions in 2024 revealed the presence of myiasis caused by botfly larvae in camels and horses. Botflies were represented by 3 species: *Cephalopina titillator,* the causative agent of camel cephalopinosis, *Rhinoestrus sp*, the causative agent of equine rhinoestrosis, and *Gastrophilus intestinalis,* the causative agent of equine gastrophilosis. The presence of *Cephalopina titillator* larvae in the nasal cavities of camels was detected in the first and second decades of September. Infestation of horses with *Rhinoestrus sp.* was detected in September in the Atyrau region only, and *Gastrophilus intestinalis* was found in May, June, and September. Flights of adult botflies were observed in September. Based on the findings of larvae at different developmental stages in the nasal cavities of camels (*Cephalopina titillator*), stomachs (*Gastrophilus intestinalis*), and nasal passages (*Rhinoestrus spp*.) of horses, as well as eggs on the horses' hair coat, we can assume that animal infestations in the studied region occur during the active flight period of adult botflies, twice a year - in May and September. Therefore, when preventing botfly larval infestations, it is necessary to consider the flight periods of specific botfly species, larval development, their emergence into the environment, and pupation.

Authors' Contributions

AA: Designed and supervised the study and drafted the manuscript. ZZ, AZh: Statistical analysis and drafted the manuscript. SB, BA, AY: Designed and conducted the study. SK: Conducted the study and drafted the manuscript. EK: Drafted the manuscript and translated. All authors have read, reviewed, and approved the final manuscript.

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Conflicts of Interest

The authors declare that they have no competing interests.

References

1 Коколова, ЛМ, Гаврильева, ЛЮ, Татаринова, ЗГ. (2024). Нематодо-гастрофилёзная инвазия у лошадей в центральной Якутии. *Иппология и ветеринария*, 3(53), 182-191.

2 Мауланов, АЗ, Кузембекова, ГБ, Мурзабаев, КЕ, Усмангалиева, СС, Жылкайдар, АЖ. (2023). Жылқы гастрофилезінің патоморфологиясы. *Ғылым және білім*, 2-1(71), 13-22.

3 Белова, ЛМ, Гаврилова, НА, Кузнецов, ЮЕ, Роберман, МГ, Ширяева, ВА. (2024). *Арахноэнтомозы продуктивных и мелких домашних животных: учебное пособие.* Проспект Науки, 188.

4 Azizi, H., Kojouri, G., Pirali, Ya., Maghami, M., Zahirabadi, MB. (2024). Clinical, pathological and epidemiological aspects of Cephalopina titillator larval, exciter in Camelus dromedaris from the Rafsanjan region, Iran. *Journal of Agriculture*, 2, 28-35.

5 Гламаздин, ИГ, Прусак-Глотов, МВ, Панова, ОА, Лагерева, ЕВ. (2016). Значение паразитарных болезней лошадей для развития мясного коневодства. *Сельскохозяйственные науки и агропромышленный комплекс на рубеже веков*, 15, 111-119.

6 Домацкий, ВН, Калугина, ЕГ. (2017). Паразитологическая ситуация по стронгилятозам лошадей в конноспортивном комплексе ГАУ Северного Зауралья и эффективность антгельминтиков. *Основные проблемы сельскохозяйственных наук,* 23-25.

7 Li, XY, Pape, T., Zhang, D. (2019). Taxonomic review of Gasterophilus (Oestridae, Gasterophilinae) of the world, with updated nomenclature, keys, biological notes, and distributions. *ZooKeys*, 891, 119-156. DOI: 10.3897/zookeys.891.38560.

8 Елизарова, ОС, Говорова, МА, Динченко, ОИ. (2021). Паразитозы как этиологическая составляющая эрозивно-язвенных поражений желудка и кишечника лошадей. А*ктуальные вопросы ветеринарной биологии*, 52, 8-12.

9 Нарчук, ЭП. (2003). Определитель семейств двукрылых насекомых фауны России и сопредельных стран (с кратким обзором семейств мировой фауны). *Зоологический институт РАН*, 294, 250.

10 Safarov, A., Kunisov, B., Arepbaev, I., Sazmand, A. (2024). First record of nasopharyngeal myiasis caused by Cephalopina titillator (Clark, 1816) in camel (Camelus dromedarius Linnaeus, 1758) in Uzbekistan. *Veterinary Parasitology: Regional Studies and Reports,* 51, 101029.

11 Zhang, B., Huang, H., Wang, H., Zhang, D., Chu, H., Ma, X., Ge, Y., Ente, M., Li, K. (2018). Genetic diversity of common Gasterophilus spp. from distinct habitats in China. *Parasit Vector*s, 11, 474. DOI: 10.1186/s13071-018-3042-y.

12 Yao, H., Liu, M., Ma, W., Yue, H., Su, Zh., Song, R., Ma, Q., Li, L., Wu, Zh., Ma, Y., Chen, G., Chem, B., Yang, J. (2022). Prevalence and pathology of Cephalopina titillator infestation in Camelus bactrianus from Xinjiang, China. *BMC Vet Res,* 18, 360. DOI: 10.1186/s12917-022-03464-5.

13 Shaalan, MG, Farghaly, SH, Khater, EI, Kenawy, MA, Ghalab, HE. (2024). Molecular characterization of the camel nasal botfly, Cephalopina titillator (Diptera: Oestridae). *Beni-Suef Univ J Basic Appl Sci,* 13, 8. DOI: 10.1186/s43088-024-00462-4.

14 Essa, IM, Al-Saadi, MH, Amanah, AM, Abd, MA, Ali, MJ. (2024). Morphological and genetic demonstration of Cephalopina titillator in dromedary camels. *Open Vet J,* 14(11), 2995-3003. DOI: 10.5455/OVJ.2024.v14.i11.28.

15 Li, Z., Zhao, XY, Tian, WL, Chen, JZ, Guo, YT, Hu, XY, Li, SN, Tian, RX, Dong, WL, Su, ZQ, Yao, G., Rang, DL, Fu, Q., Shi, HJ. (2020). Investigation of parasitic infection in the digestive tract of Bactrian camels in some areas of Xinjiang. *Heilongjiang Animal Science and Veterinary Medicine*, 15, 98-100.

16 Mahdy, OA, Attia, MM. (2021). Comparative micro-morphological and phylogenetic analysis between Rhinoestrus purpureus and Rhinoestrus usbekistanicus (Diptera: Oestridae) larvae and its adults. *International Journal of Tropical Insect Science,* 41, 241-250. DOI: 10.1007/s42690-020-00199-4.

17 Ibrahim, M. (2022). Larvae and adult flies of Rhinoestrus purpureus and R. usbekistanicus: morphology and pupation (Diptera: Oestridae). *Vet Ital*, 58(2). DOI: 10.12834/VetIt.2085.12058.2.

18 Барашкова, АИ. (2021). Продолжительность развития стадии куколки желудочного овода (Gasterophilidae) в Якутии. *Иппология и ветеринария,* 2(40), 68-72.

19 Liu, SH, Li, K., Hu, DF. (2016). The incidence and species composition of Gasterophilus (Diptera, Gasterophilidae) causing equine myiasis in northern Xinjiang, China. *Vet Parasitol,* 217, 36-38. DOI: 10.1016/j.vetpar.2015.12.028.

20 Carbonell, JD, Bartolome, IM, Meana, A. (2023). Equine cutaneous gasterophilosis in an era of selective parasite control. *Equine Veterinary Education*, 35, 465, e608-e613.

21 Ibrayev, B., Lider, L., Bauer, Ch. (2015). Gasterophilus spp. infections in horses from northern and central Kazakhstan. *Veterinary Parasitology,* 207(1-2), 94-98. DOI:10.1016/j.vetpar.2014.11.015.

22 Tavassoli, M., Bakht, M. (2012). Gasterophilus spp. myiasis in Iranian equine. *Sci Parasitol*, 13, 83-86.

23 Ozdal, N., Bicek, K., Orunc, O., Deger, S. (2010). Presence of Gasterophilus species in horses in Van region. *YYU Vet Fak Derg,* 21, 87-90.

24 Ятусевич, АИ, Стасюкевич, СИ, Столярова, ЮА, Патафеев, ВА, Кузнецова, ДС. (2020). Распространение и видовой состав оводов лошадей в Республике Беларусь. *Ветеринарный журнал Беларуси*, 2(13), 66-70.

25 Ноева, А. (2022). Анатомо-морфологическое исследование большого желудочного овода Gasterophilus intestinalis на примере чурапчинских лошадей. *Юный ученый*, S5-1(57-1), 74-75.

26 Голуб, ВБ, Цуриков, МН, Прокин, АА. (2012). Коллекции насекомых: сбор, обработка и хранение материала. *Товарищество научных изданий КМК,* 339.

27 Вацаев, ШВ, Черных, ОЮ, Гунашев, ША. (2023). Распространение подкожного овода крупного рогатого скота и меры борьбы с ним в Чеченской Республике. *Известия Дагестанского ГАУ*, 4(20), 71-76.

28 Esri. (n.d.). Getting Started with ArcMap. ArcGIS Desktop. https://desktop.arcgis.com/ru/arcmap/latest/get-started/main/get-started-with-arcmap.htm

References

1 Kokolova, LM, Gavrileva, LYu, Tatarinova, ZG. (2024). Nematodo-gastrofileznaya invaziya u losadei v tsentralnoi Yakutii. *Ippologiya i veterinariya*, 3(53), 182-191. [*in Russ*].

2 Maulanov, AZ, Kuzembekova, GB, Murzabaev, KE, Usmangalieva, SS, Jylkaidar, AJ. (2023). Jylqy gastrofileziniń patomorfologıyasy. *Ǵylym jáne bilim*, 2-1(71), 13-22. [*in Kaz*].

3 Belova, LM, Gavrilova, NA, Kuznecov, YuE, Roberman, MG, Siryaeva, VA. (2022). *Arahnoentomozy produktivnyh i melkih domashnih zhivotnyh: uchebnoe posobie.* Prospekt Nauki, 188. [*in Russ*].

4 Azizi, H., Kojouri, G., Pirali, Ya., Maghami, M., Zahirabadi, MB. (2024). Clinical, pathological and epidemiological aspects of Cephalopina titillator larval, exciter in Camelus dromedaris from the Rafsanjan region, Iran. *Journal of Agriculture*, 2, 28-35.

5 Glamazdin, IG, Prusak-Glotov, MV, Panova, OA, Lagereva, EV. (2016). Znachenie parazitarnyh boleznej loshadej dlya razvitiya myasnogo konevodstva. *Selskohozyajstvennye nauki i agropromyshlennyij kompleks na rubezhe vekov,* 15, 111-119. [*in Russ*].

6 Domackij, VN, Kalugina, EG. (2017). Parazitologicheskaya situaciya po strongilyatozam loshadej v konnosportivnom komplekse GAU Severnogo Zauralya i effektivnost antgelmintikov. *Osnovnye problemy selskohozyajstvennyh nauk*, 23-25. [*in Russ]*.

7 Li, X-Y, Pape, T., Zhang, D. (2019). Taxonomic review of Gasterophilus (Oestridae, Gasterophilinae) of the world, with updated nomenclature, keys, biological notes, and distributions. *ZooKeys*, 891, 119-156. DOI: 10.3897/zookeys.891.38560.

8 Elizarova, OS, Govorova, MA, Dinchenko, OI. (2021). Parazitozy kak etiologicheskaya sostavlyayusaya erozivno-yazvennyh porajenii jeludka i kisechnika losadei. A*ktualnye voprosy veterinarnoi biologii*, 52, 8-12 [*in Russ*].

9 Narchuk, EP. (2003). Opredelitel semejstv dvukrylyh nasekomyh fauny Rossii i sopredelnyh stran (s kratkim obzorom semejstv mirovoj fauny). *Zoologicheskij institut RAN*, 294, 250. [*in Russ*].

10 Safarov, A., Kunisov, B., Arepbaev, I., Sazmand, A. (2024). First record of nasopharyngeal myiasis caused by Cephalopina titillator (Clark, 1816) in camel (Camelus dromedarius Linnaeus, 1758) in Uzbekistan. *Veterinary Parasitology: Regional Studies and Reports*, 51, 101029.

11 Zhang, B., Huang, H., Wang, H., Zhang, D., Chu, H., Ma, X., Ge, Y., Ente, M., Li, K. (2018). Genetic diversity of common Gasterophilus spp. from distinct habitats in China. *Parasit Vectors,* 11, 474. DOI: 10.1186/s13071-018-3042-y.

12 Yao, H., Liu, M., Ma, W., Yue, H., Su, Zh., Song, R., Ma, Q., Li, L., Wu, Zh., Ma, Y., Chen, G., Chem, B., Yang, J. (2022). Prevalence and pathology of Cephalopina titillator infestation in Camelus bactrianus from Xinjiang, China. *BMC Vet Res*, 18, 360. DOI: 10.1186/s12917-022-03464-5.

13 Shaalan, MG, Farghaly, SH, Khater, EI, Kenawy, MA, Ghalab, HE. (2024). Molecular characterization of the camel nasal botfly, Cephalopina titillator (Diptera: Oestridae). *Beni-Suef Univ J Basic Appl Sci*, 13, 8. DOI: 10.1186/s43088-024-00462-4.

14 Essa, IM, Al-Saadi, MH, Amanah, AM, Abd, MA, Ali, MJ. (2024). Morphological and genetic demonstration of Cephalopina titillator in dromedary camels. *Open Vet J*, 14(11), 2995-3003. DOI: 10.5455/OVJ.2024.v14.i11.28.

15 Li, Z., Zhao, XY, Tian, WL, Chen, JZ, Guo, YT, Hu, XY, Li, SN, Tian, RX, Dong, WL, Su, ZQ, Yao, G., Rang, DL, Fu, Q., Shi, HJ. (2020). Investigation of parasitic infection in the digestive tract of Bactrian camels in some areas of Xinjiang. *Heilongjiang Animal Science and Veterinary Medicine*, 15, 98-100.

16 Mahdy, OA, Attia, MM. (2021). Comparative micro-morphological and phylogenetic analysis between Rhinoestrus purpureus and Rhinoestrus usbekistanicus (Diptera: Oestridae) larvae and its adults. *International Journal of Tropical Insect Science*, 41, 241-250. DOI: 10.1007/s42690-020-00199-4.

17 Ibrahim, M. (2022). Larvae and adult flies of Rhinoestrus purpureus and R. usbekistanicus: morphology and pupation (Diptera: Oestridae). *Vet Ital*, 58(2). DOI: 10.12834/VetIt.2085.12058.2.

18 Baraskova, AI. (2021). Prodoljitelnost razvitiya stadii kukolki jeludochnogo ovoda (Gasterophilidae) v Yakutii. *Ippologiya i veterinariya,* 2(40), 68-72. [*in Russ*].

19 Liu, SH, Li, K., Hu, DF. (2016). The incidence and species composition of Gasterophilus (Diptera, Gasterophilidae) causing equine myiasis in northern Xinjiang, China. *Vet Parasitol,* 217, 36-38. DOI: 10.1016/j.vetpar.2015.12.028.

20 Carbonell, JD, Bartolome, IM, Meana, A. (2023). Equine cutaneous gasterophilosis in an era of selective parasite control. *Equine Veterinary Education,* 35, 465, e608-e613.

21 Ibrayev, B., Lider, L., Bauer, Ch. (2015). Gasterophilus spp. infections in horses from northern and central Kazakhstan. Veterinary Parasitology, 207(1-2), 94-98. DOI:10.1016/j.vetpar.2014.11.015

22 Tavassoli, M., Bakht, M. (2012). Gasterophilus spp. myiasis in Iranian equine. *Sci Parasitol*, 13, 83-86.

23 Ozdal, N., Bicek, K., Orunc, O., Deger, S. (2010). Presence of Gasterophilus species in horses in Van region. *YYU Vet Fak Derg,* 21, 87-90.

24 Yatusevich, AI, Stasyukevich, Sİ, Stolyarova, YUA, Patafeev, VA, Kuznetsova, DS. (2020). Rasprostranenie i vidovoi sostav ovodov losadei v Respublike Belarus. *Veterinarnyi jurnal Belarusi*, 2 (13), 66-70. [*in Russ*].

25 Noeva, A. (2022). Anatomo-morfologicheskoe issledovanie bolşogo jeludochnogo ovoda Gasterophilus intestinalis na primere churapchinskih losadei. *Yunyi uchenyi,* S5-1(57-1), 74-75. [*in Russ*].

26 Golub, VB, Curikov, MN, Prokin, AA. (2012). Kollekcii nasekomyh: sbor, obrabotka i hranenie materiala. *Tovarishestvo nauchnyh izdanii KMK*, 339. [*in Russ*].

27 Vatsaev, SV, Chernyh, OYu, Gunasev, SA. (2023). Rasprostranenie podkojnogo ovoda krupnogo rogatogo skota i mery borby s nim v Chechenskoi Respublike. *Izvestiya Dagestanskogo GAU*, 4(20), 71-76. [*in Russ*].

28 Esri. (n.d.). Getting Started with ArcMap. ArcGIS Desktop. https://desktop.arcgis.com/ru/arcmap/latest/get-started/main/get-started-with-arcmap.htm