

**Infestation of horses by the causative agents of gasterophilosis (Diptera: Gasterophilidae): the species composition and the north-eastern border of the area in the Republic (Sakha) of Yakutia of the Russian Federation**

Alexander Dmitrievich Reshetnikov, Anastasia Ivanovna Barashkova, Zasim Sidorovich Prokopyev

Yakut Research Institute of Agriculture, Yakutsk, Russian Federation

E-mail: [yniicx@mail.ru](mailto:yniicx@mail.ru)

**Abstract.** We have found that the areal of distribution of horses and that of gadflies of the order Gasterophilus don't match. The northern border of the Yakut herd horses is considerably greater than the spread of gastric gadflies of horses. Boundary of the natural habitat of horses extends to 69-70° N latitude and 156° E longitude, while the border area of natural habitat of gadflies is limited by more southerly areas and extends from 69° N latitude and 146° E longitude. In Central and Western zones an extent of infestation is 100%, in the North-Eastern region it ranges from 100 to 0%. Species composition of gastric gadflies in Central Yakutia is presented by 5 species, and the species is *G. intestinalis* – 69.5%, *G. veterinus* – 12.8%, *G. pecorum* – 13.4%, *G. haemorrhoidalis* – 3.8% and *G. nigricornis* – 1.1-1.6%. In West and Northeast regions species composition has 4 types, except the last one.

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### Introduction

Gastric gadflies of horses can be found in all continents of the world [1-3]. In the research papers of K. Y. Grunin [4-5] questions about the geographic distribution of gastric gadflies of horses, their species composition and biology on the vast territory of Yakutia have remained virtually unexplored. Only with respect to the *Gasterophilus intestinalis* and *G. haemorrhoidalis* there is an indication that in the vicinity of Yakutsk city in May there was flight their females and males. V.M. Dmitriev devoted considerable attention to the study of ecology of gadflies of horses in Central and Vilyuiskaya areas of Yakutia and to the development of methods of combating them [6]. As a result he revealed that 4 species of gastric gadflies parasitize in horses: *G. intestinalis*, *G. veterinus*, *G. pecorum* and *G. haemorrhoidalis*, with *G. intestinalis* being the dominant species. During the study of the problem the infestation of horses was close to 100% with an intensity of 192 larvae per animal, and in some cases up to 690 larvae per animal. At a later date the study of the problem of gasterophilosis was continued [7-8].

The lack of specific data on natural habitat of the gastric gadflies of horses and the degree of infestation with gasterophilosis in Yakutia and in particular in the North-East of the republic, which is a developed area of herd horse breeding, does not allow to estimate the whole epizootic situation in the Republic of Sakha (Yakutia). Based on the fact that horses are host of these insects K.Y. Grunin

concluded on coincidence of boundaries of habitat of parasites and animals emphasizing that the species composition and the degree of infestation vary greatly in different climates [4]. Despite the severity of the climate, Yakut horses are common in all Arctic encampments being far above the Arctic Circle. The aim of our research is to elucidate the northern border of gastric gadflies of horses in the Northeast Asia.

### Materials and methods

#### Field of study:

Yakutia is located in the North-East Asia within 76°3'-55°29' N latitude and 105°3'-162°51' E longitude. Area of the Yakutia (3,103,200 sq. km.) occupies 18% or almost one fifth of the whole territory of the Russian Federation. It's an area of the rigorous climate - pole of cold in the northern hemisphere, the territory of extreme low temperature fluctuations. An average long-term temperature in January in Oymyakon and Verkhoyansk is minus 49-50°C. In Oymyakon kettle the minimum temperatures reach minus 71 °C, and in Verkhoyansk - minus 68 °C, and in the central regions - minus 66 °C. Summer is short, but relatively hot (in most of the territory plus 36-38 °C, in the coast area plus 29-32°C), with long-term sunshine (non-stop polar day). The total number of herd horses in Yakutia during the study period was 168,200 animals.

#### Material and methods:

The experimental part of the research work was carried out in farms and in the laboratory of

Arachnoentomology of Yakutsk Research Institute of Agriculture in 2000-2014 yy. The study of distribution and infestation of horses by gastric gadflies in the Republic of Sakha (Yakutia) was carried out during the inspection of the digestive tract (oral cavity, esophagus, stomach, duodenum and rectum) from 894 animals slaughtered for food. Also we used the material produced by collecting naturally departed for pupation larvae of gadflies, and those caught in nature habits. After collection, counting and washing larvae were fixed in 70° alcohol (instar-II) or Barbogallo liquid. The species of larvae and flies of the collected gastric gadflies were determined by K. Ya Grunin.

### Results and discussion

The extent of infestation (percentage of infestation, invasiveness) of horses in the Central and Western areas of the republic reached up to 100% of the intensity of infestation (an average number of worms for infected animals of the same species in the herd) up to  $230 \pm 12.0$ - $225 \pm 31.7$  larvae per animal. The degree of invasiveness of horses in the Northeast zone varies widely from 0 to 100%, while an intensity of infestation also varies greatly - from 0 to  $193.9 \pm 36.1$ . In Momsk and Verkhoyansk districts the extent of infestation is found equally high being equal to 100%. However, intensity of infestation in Momsk district ( $121.8 \pm 20.6$ ) is lower than in the Verkhoyansk district ( $193.9 \pm 36.1$ ) by 72.1 larvae per animal. In Abyisk district the degree of invasiveness is 35.7%, and the intensity of infestation is only  $44.3 \pm 11.7$  larvae. No larvae were found in horses of Srednekolymsk district (Table 1).

**Table 1. Infection rate of horses by larvae of gastric gadflies in the Republic of Sakha (Yakutia) (data for 1985-1999 yy)**

Zones and encampments	Examined	Infected	Extent of infestation, %	Intensity of infestation M $\pm$ m
<b>North-East Zone</b>				
Srednekolymsk	67	0	0	0%
Momsk	118	118	100	$121.8 \pm 20.6$
Verkhoyansk	93	93	100	$193.9 \pm 36.1$
Abyisk	84	29	35.7	$44.3 \pm 11.7$
TOTAL AREA:	362	240	66.3	$122.5 \pm 14.4$
<b>Central Yakutia</b>				
Khangalassk	183	183	100	$229.4 \pm 40.4$
Namsk	67	67	100	$175.0 \pm 2.4$
Yakutsk (suburb)	78	75	96.2	$221 \pm 16.6$
Tatinsk	33	33	100	$272.8 \pm 28.7$
Megino-Kangalassk	42	42	100	$244.7 \pm 13.9$
Churapchinsk	10	10	100	$251.1 \pm 21.8$
Olekminsk	48	48	100	$227.3 \pm 32.3$
TOTAL AREA:	461	458	99.3	$225 \pm 31.7$
<b>West Zone</b>				
Verkhnevilyuisk	11	11	100	$268.0 \pm 16.5$
Nyurbinsk	10	10	100	$216.0 \pm 36.4$
Suntarsk	21	21	100	$201.2 \pm 21.3$
Vilniisk	30	30	100	$228.6 \pm 17.9$
TOTAL AREA:	71	71	100	$230 \pm 12.0$
Total in the republic	894	769	86.0	$194.0 \pm 12.1$

The decrease in the number of parasitic larvae of gastric gadflies is explained by severe climatic conditions. However, the North-East Zone is a region of development of horse breeding, where up to 30% of the total number of horses are

concentrated. In the area Kolymsk and Verkhoyansk breed of Yakut horses are propagated. They're characterized by exceptionally high intrabreed characteristics. Horses of Kolymsk and especially Verkhoyansk are characterized by extremely good quality of breed. In the Northeast there's a stud farm "Aleko-Kelsk" of the area of Srednekolymsk, breed herd "Stolby" of Verkhoyansk district and "Oimyakon" herd of Oimyakon district.

Momsk and Verkhoyansk areas where a high extent and intensity of infestation were found are located in river valleys Indigirka, Moma, Sellenyah, Jana, Adycha. River valleys are bounded by a chain of young mountains - Momsk, Chersk, Verkhoyansk ranges. And for this reason they form a kind of microclimate characterized by the severity of winter (cold pole - 71 °C below zero) and high temperatures in summer. Abyisk and Srednekolymsk districts are located in Abyisk and Kolymsk lowlands. The climate in these areas is very different from the Momsk and Verkhoyansk districts. Winter in these districts is relatively mild due to the influence of the Pacific and Arctic oceans, but summer is not too hot, as in the hollows of the mountains. All these conditions determine the amount of effective temperatures necessary for the development of a gadfly at the stage of the larva.

In order to determine the species composition of gastric gadflies parasitized on the horses of Yakutia we have collected 76,470 larvae (instar-II and instar-III). The number of larvae instar-II was 11.9% or 9.100 specimen, while instar-III was 88.1 and 67,370 respectively. The results of processing of this material are shown in the Table 2. Besides the previously identified four species of gadflies in the central zone of Yakutia by V.M. Dmitriev (1971) in the horses of farms Hangalassk, Namsk districts and suburban areas of Yakutsk, we have found *G. nigricornis* (confirmed by M. Rastegaev - VNIIVEA) for the first time. Its larvae parasitized in the initial part of the duodenum and were recognizable by a bright green color (Fig. 1). Thus, the fauna of Gasterophilidae of the Central Yakutia is presented by 5 species. The dominant are: *G. intestinalis* (56.3% of the collection), *G. pecorum* (22.8%) and *G. veterinus* (16.8%) while *G. nigricornis* and *G. haemorrhoidalis* are encountered in a smaller amounts (0.4 and 3.7% respectively). The closest habitat of *G. nigricornis* is the Republic of Buryatia [9]. Analysis of summer temperature regimes in the Central Yakutia and Buryatia indicates their similarities. We believe this is the reason for habitat of gastric gadflies of horses in Central Yakutia. So, the absolutely maximum temperature in July and August in both republics is equal to 37-38°C, and the number of days with an average

temperature of above 10 °C is 80-100 days. An average monthly temperature in Yakutsk is 5-9 °C in May, 15.4 °C in June, 18.7 °C in July and 14.8 °C in August. At the same time an average temperature of the earth surface reaches up to 35-40 °C [10-12], which is sufficient for the development of larvae.

Following the analysis of the collection of larvae we can see that the fauna of gastric gadflies of horses in the North-East Yakutia is presented by 4 species of which the dominant are: *G. intestinalis* – 42.1%, and *G. veterinus* – 29.4%, while *G. pecorum* – 13.9%, and *G. haemorrhoidalis* – 14.6% are less detected.



FIG. 1: Larvae of *G. nigricornis*, instar-III

Table 2 - Species composition of gastric gadflies living in Yakutia (1985-1999 yy)

Zones	Districts	including (%)				
		<i>G.intestinalis</i>	<i>G.veterinus</i>	<i>G.pecorum</i>	<i>G. haemorrhoidalis</i>	<i>G.nigricornis</i>
North-East	Momsk	45.9	30.41	9.9	13.95	0%
	Verkhoyansk	31.93	26.91	24.85	16.31	0%
	Abyisk	49.9	35.6	2.8	11.7	0%
Total for the zone:		41.6	30.1	14.3	14.4	0%
Central	Khangalassk	79.78	6.71	12.6	0.22	1.23
	Namsk	59.25	16.87	13.25	9.0	1.6
	Yakutsk	39.69	27.26	25.89	7.16	1.5
	Tattinsk	68.3	15.4	8.	8.1	0%
	Megino-Kang.	75.6	9.1.	2.9	12.4	0%
	Churapchinsk	63.4	21.9	6.8	7.9.	0%
Olekminsk	71.8	18.4	5.5	4.3	0%	
	Total for the zone:	69.5	12.8	13.4	3.8	1.1
West	Verhnevilovoy	64.6	17.8	13.2	4.4	0%
	Nyurbinsk	58.3	9.5	14.9	17.4	0%
	Suntarsk	63.7	18.1	15.4	2.8	0%
	Viluisk	74.4	20.3	3.2	2.1	0%
Total for the zone:		64.87	16.0	11.82	7.3	0%

Based on the data available in research papers on the species composition and invasiveness of horses by gadflies, we compiled the scheme of geographic range of gastric gadflies in the country. The data presented in Fig. 5 show how widespread is the areal of gastric gadflies in the country. This causes an invasiveness of animals by gasterophilosis – up to 93.6-100%. Unfavorable epidemiological picture on gasterophilosis of solid-hooved has been noted in the republics of Central Asia and Kazakhstan, in the Volga region, and according to our research, on the whole territory of Yakutia. However, the intensity of infestation in the study region was equal to  $194.0 \pm 12.1$ , which is significantly lower than that indicator at the national level.

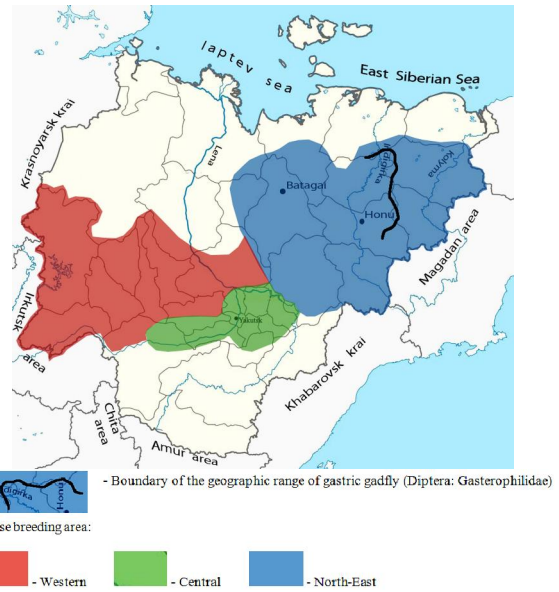


FIG. 2: North-eastern border of the areal of gastric gadflies of horses (Diptera: Gasterophilidae) in the Republic (Sakha) Yakutia of the Russian Federation

Summarizing the results of the conducted research, we can say that the number of larvae infesting horses in the Northeast and Central regions of the country - namely, in the North-East of Yakutia - is less than in regions with a mild climate. The number of species of gastric gadflies also tends to decrease. So, in the Republic of Buryatia, Chita Region the fauna of Gasterophilidae is presented by 6 species, in Central Yakutia – 5, in the Northeast zone of the republic - only 4 species. An intensity of infestation also depends on climatic conditions and is equal to up to 1000, 226.1, 153.6 larvae per horse respectively. We have found that gastric gadflies don't parasitize in horses bred in the Kolymsk lowland, although the region is famous for its development of horse breeding, as evidenced by the presence of the stud farm. This allowed us to establish the northern boundary of gastric gadfly areal passing from 69° N latitude and 146° E longitude (Fig. 2) and conclude that the areal border of gastric gadfly and horses do not match.

**Conclusion**

1. The distribution area of the horses and the distribution area of gadflies of the order Gasterophilus don't match. The northern border of the Yakut herd horses is vastly superior to the border of gastric gadflies of horses. Boundary of the geographical range of horses extends to Srednekolymsk and Abyisk districts (69-70° N

latitude, 156° E longitude), while the border of geographical range of gadflies is limited to more southern regions without affecting of Srednekolymsk district and extends from 69° N latitude and 146° E longitude.

2. Gastric gadflies are common in farms of the Republic of Sakha (Yakutia). In Central and Western zones the extent of infestation is 100% with an average intensity of infestation equal to  $225 \pm 31.7$ - $230 \pm 31.7$  of larvae per animal. In the Northeast zone this figure varies. In Verkhoyansk, Oimyakonsk and Momsk districts the extent of infestation is 100%, and in Abyisk and Srednekolymsk districts - 35.7 and 0%, respectively, with an intensity of infestation varying from  $193.9 \pm 36.1$  to 0 in larvae. The species composition of gastric gadflies in Central Yakutia is presented by 5 species, of which the dominant is *G. intestinalis* – 69.5%, *G. veterinus* is less common – 12.8%, *G. pecorum* – 13.4%, *G. haemorrhoidalis* – 3.8% and *G. nigricornis* – 1.1-1.6%. In West and Northeast regions the species composition consists of 4 species, except the last one. In the western zone a dominant species is *G. intestinalis* (64.87%) only, in the North-East - two species of *G. intestinalis* (41.5%) and *G. veterinus* (30.1%). Non-dominant species in the first zone are *G. veterinus* (16.0%), *G. pecorum* (11.82%) and *G. haemorrhoidalis*, and in the second one - *G. pecorum* (14.3%) and *G. haemorrhoidalis* (14.4%).

#### Corresponding Author:

Dr. Reshetnikov Alexander Dmitrievich  
Yakut Research Institute of Agriculture, Yakutsk,  
Russian Federation  
E-mail: [yniicx@mail.ru](mailto:yniicx@mail.ru)

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#### References

1. Grunin, K.Y., 1955. Fauna of the USSR. Insects of the order Diptera. Gastric gadflies (Gastrophilidae), Vol. 17, 1: 1-96.
2. Grunin, K.Y., 1953. The larvae of gadflies in pets of USSR. Key to the fauna of the USSR. Moscow, Leningrad: Publishment of Academy of sciences of USSR, pp: 1-124.
3. Dmitriev, V.M., 1971. Materials for the study of the species composition of the cavitary gadflies of horses in Yakut ASSR and seeking funding and methods of combating them. Science works of VNIIVS, V: 103-106.
4. Reshetnikov, A.D., 1990. Phenological prognosis and signaling of terms of development of gastric gadflies parasitizing in horses of the Northeast Yakutia. Therapeutic and preventive measures for the protection of animal health in Yakutia: collection of research papers. Novosibirsk: Yakut Research Institute of Agriculture (YRIA), pp: 39-45. Novosibirsk.
5. Rastegaev, Y.M., 1979. Prevalence and species composition of horse gadflies in the Buryat ASSR and in the Mongolian People's Republic (Oestridae, Gastrophilidae). Parasitology, 13: 547-548.
6. Gavrilova, M.K., 1973. Climate of the Central Yakutia. Yakutsk: Publishment Yakutknigizdat, pp: 118.
7. Schwer, C.A. and S.A. Izumenko, 1982. Climate of Yakutsk. Leningrad: Publishment Gidrometeoizdat, pp: 1-246.
8. Zhukov, V.M., 1960. Climate of Buryat ASSR. Ulan-Ude: Publishment Buriat, pp: 188.