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## VECTOR OF DISTRIBUTION, DYNAMICS OF THE NUMBER OF IXODIC TICKS IN THE TERRITORY OF YAKUTIA AND THE BACKGROUND OF THE EXPLOSION OF LOIMOPOTENTIAL OF TICK INFECTIONS IN HUMANS

### ABSTRACT

The authors report the data of medical and entomological monitoring.

The **purpose** of the study was to determine vectors of distribution and dynamics of the number of ixodic ticks in the territory of Yakutia and the background of the explosion of loimopotential of tick infections in humans.

According to the data of medical and entomological monitoring, an administrative-zonal (cartographic) format has been compiled; vectors of ectoparasite distribution are determined, including laboratory-indicative indicators, their contamination by designated infectious agents (causative agents of tick-borne encephalitis (TBE), ixodic tick-borne borreliosis (ITBB) and human granulocytic anaplasmosis (HGA)).

Sporadic and group cases of people's diseases, including a mixt-infection, detected against the background of general infection among the population indicate certain clinical, epidemiological, cause-and-effect risk factors of their loimopotential.

### Findings:

1. The intense south-north vector of ixodic tick propagation and transmissivity is stated.
2. It has been established that ticks are contaminated with tick-borne encephalitis, borreliosis, and there is an increased risk potential for human morbidity.
3. From the standpoint of autochthonousness in "silent" foci latent infection among the population is revealed.

The area of the taiga tick (*Ixodes persulcatus* Schulze), the main custodian and carrier of the causative agent of tick-borne encephalitis (TBE), is almost completely located on the territory of the Russian Federation and has expanded in the last decade to the north and east [2-5, 11, 12], forming the loimopotential [5] of epidemiological risks for other tick-borne natural focal infections (ITBB, HGA).

Earlier on the topic, including the number of registrations of the attack of ticks on a person, quite informative materials were published [1, 3, 9, 13].

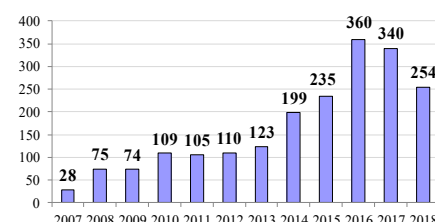
At present, cases of ixodic tick attacks on the territory of Yakutia have been noted in all administrative areas of southern,

southwestern and central Yakutia (Fig. 1).

Every year the largest number of cases is registered in the Aldan and Neryungri districts - over 43% of the total number of attacks in the Republic. Lensky and Olekminsky districts are in second place - up to 20%. In Central Yakutia, the highest incidence of ixodide attacks is noted in the Khangalassky district, Yakutsk and in the Namsky district, with over 10 cases recorded annually in the first two. In the districts over the Lena River, the population of Megino-Kangalassky and Amginsky districts is most often in contact with ticks. In most of the remaining territories, isolated cases of tick suction are recorded, up to a maximum of 7 (Suntarsky district). The most northern points where tick victims were found are the environs of Sangar and Kobyai (63 degrees north latitude, Kobyai district), and Kaskil (Tomponsky district) in the eastern zone of Yakutia.

This report provides additional data [1, 9, 10] from 2007 to 2018. Since the number of ticks at the limit of the range is extremely low, we estimate the situa-

tion on an indirect basis - the dynamics of the number of people affected by bites - the parasite suckers (Fig. 2).

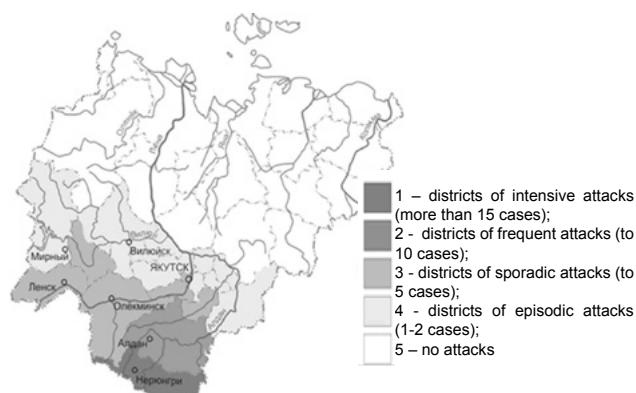


**Fig.2.** Dynamics of the number of tick attacks on people.

Over the past 14 years, there has been a sharp increase in the number of registered individuals affected by tick attacks. In general, if from 1975 to 1996, 182 victims were registered, then for 2000–2009 their number was 363, in the next 5 years (2010 – 2014) - 644, and for 2015–2017 - 933. It should be noted that as in August 2018 only 254 cases were recorded, then in total for the last 5 years (2014–2018) the growth trend persists - 1388 cases.

The mosaic character of the spread of foci is confined to anthropogenically altered sections of taiga and river valleys [6], as well as in areas adjacent to AYAM railway line (the highest proportion of bites-suckers of ticks was observed in Neryungri - 28.4% and Aldan districts - 23.3%).

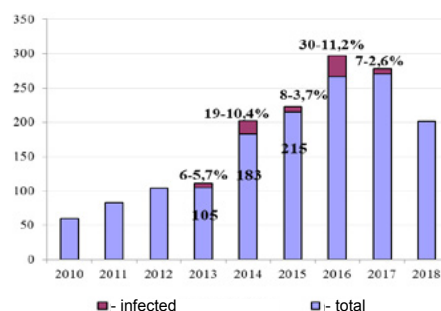
The territory of the Republic Sakha



**Fig. 1.** Frequency of taiga ticks' (area of *I. persulcatus*) attacks on people in Yakutia.

(Yakutia) officially is not endemic for tick-borne encephalitis, since the tick virus activity and the morbidity of people here previously had a sporadic character [6], which assumed the character of intensity. In 2013 out of 105 specimens of the studied ticks, taken from people in 6 cases, positive results of their infection were obtained (5.7%). Contacts with virus-borne mites occurred in the Churapchinsky, Khangalassky, Namsky, Lensky, Neryungri areas and Yakutsk. In 2014, in a laboratory study of 183 specimens of ticks taken from people, 18 were already infectious (9.8%), and positive results were determined in studies of blood suckers from Aldan, Megino-Kangalassky, Namsky, Neryungri, Nyurba, Olekminsky, Suntarsky, Churapchinsky districts and Yakutsk (Fig. 3).

For 2012-2017 1332 studies of ixodid ticks taken from humans and animals by epidemiological indications using the



**Fig. 3.** The number of examined ticks and their infection in the period 2010-2018.

ELISA method were carried out. The TBE virus antigen was found in 70 specimens of ixodid ticks (5.2%).

In 2015 a modern technique (PCR) of tick NA detection for tick-borne encephalitis virus (TBE), tick-borne borreliosis pathogen (TCB), human granulocytic anaplasmosis (HGA) and human monocytic ehrlichiosis (HME) pathogens was introduced.

For 2016-2017 at performing PCR using multiplex tests on TBE, ITBB, HGA, HME, in the tested 528 specimens positive findings made 2%, in 10 specimens of ixodid ticks *Borrelia burgdorferi* RNA were found (Aldansky - 5; Yakutsk - 3; Namsky - 1; Neryungri - 1). In 2018 at conducting 201 laboratory studies of parasites, no positive results were found on TBE. However, in pool studies, HGA RNA was detected: out of 35 - 1 (2.8%), out of 28 - 1 (3.5%) and in 4 (11.4%) DNA of the ITBB pathogen was found.

Thus, one can confirm that in the territory of Yakutia there is not only an expansion in the area, but also an increase in

the activity and infection of ixodid ticks by various pathogens [14].

New positive results of tick-borne encephalitis causative agent in 11 and borreliosis in 5 districts of the Republic were obtained, which complicates the epidemiological situation of these transmissible infections, manifestations of the mixt-forms of the disease in humans are not excluded.

The potential of autochthonous risk of infection by tick-borne encephalitis is aggravated by the transport of up to 5.4% of victims who arrived from the territory of other Russian subjects, as well as from near and far abroad. Interterritorial cases of diseases were diagnosed in Yakutia from Primorye, Eastern Siberia, the Baltic states and the Czech Republic.

Borreliosis, the local cases of which were found in the Neryungri, Lensky districts and in the village Zhaatai, imported ones – in Mirny and Yakutsk, requires special attention.

In August 2018, 2 residents of the village Tokko Olekminsky district were diagnosed with tick-borne encephalitis (TBE) (patient A-nov, born in 1971) and mixt infection (TBE + ITBB) (patient D, born in 1973). The situation deserves clinical, epidemiological and prognostic assessment. Clinical and epidemiological studies have been confirmed by the results of indicative, virus-immunological parameters, pathological changes in the cerebrospinal fluid and the determination of specific antibodies aVTBE Ig M, aVTBE IgG and ITBB IgG against tick-borne encephalitis and borreliosis pathogens, the value of which is taken as evidence-based tests.

Epidemiological echo [6-8] testifies that the first case of tick-borne encephalitis, diagnosed in 1964 (isolation of the TBE virus from the cerebrospinal fluid) has its hidden "silent" and real-combined manifestation in the present.

#### Findings:

1. The intense south-north vector of ixodid tick propagation and transmissivity is stated.

2. It has been established that ticks are contaminated with tick-borne encephalitis, borreliosis, and there is an increased risk potential for human morbidity.

3. From the standpoint of autochthonousness in "silent" foci latent infection among the population is revealed.

4. The incidence of people is episodic, acquires group manifestations, including mixt-infections.

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## ARCTIC MEDICINE

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## MAJOR DEMOGRAPHIC TENDENCIES OF THE ARCTIC AND SUB-ARCTIC ZONE OF RUSSIA

### ABSTRACT

The **aim** of the research: was the description of the general evolution of basic demographic indicators of the territories of the Arctic zone of the Russian Federation for the period 1993-2017.

**Methods.** A description of the main demographic indicators for the period of 1993-2017 in the Krasnoyarsk Area, the Arkhangelsk, Murmansk regions, the Komi Republics, the Sakha (Yakutia), the Nenets, the Yamalo-Nenets and the Chukotka Autonomous Districts in comparison with the national indicators.

The data of the Central Statistical Database of the Federal State Statistics Service, the Russian database on fertility and mortality were used.

The analysis used indicators: standardized total mortality rates, life expectancy at birth, infant mortality, total fertility rate, demographic burnout.

**Conclusions.** Despite the general positive demographic trends, the territories of the Arctic zone of Russia remain areas of a tense demographic situation, manifested in supermortality, insufficient fertility for the reproduction of the population, migration outflow of the population, which leads to continued depopulation of these regions.

**Keywords:** Arctic, fertility, mortality, migration.

**Introduction.** The modern territorial concept of the Arctic zone was formed by a Presidential Decree of May 2, 2014, which determined the boundaries of the

land areas of the zone [4]. Moreover, only a part of large territorial entities is included in this zone. In this regard, we have analyzed the enlarged territories, namely

the regions, districts, territories, taking as a basis the assumption about the similarity of the trends in them in general and in their individual territories in particular.