

Article

## Analysis of the Species Composition of Mosquitoes in the Foci of Leishmaniasis in the Urgut District of the Samarkand Region

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**Abstract:** This study investigates the species composition and ecological characteristics of mosquitoes in the Urgut district of Samarkand, focusing on their role as carriers of leishmaniasis. Despite the known prevalence of leishmaniasis in Uzbekistan, gaps exist in understanding the specific species distribution in this region. The research employed field studies, morphometric, and statistical analyses to identify and quantify mosquito species. Findings reveal that *Ph. Sergenti* and *Ph. Longiductus* are the dominant species and significant vectors of leishmaniasis in Urgut. These results underscore the importance of targeted mosquito control measures, with implications for reducing disease transmission in endemic areas.

**Keywords:** Mosquitoes, Phlebotominae, Leishmania, *Ph. Papatasi*, *Ph. Sergenti*, *Ph. Longiductus*, *Ph. Alexandri*, *S. grecovi*

### 1. Introduction

Mosquitoes (subfamily Phlebotominae) are blood-sucking representatives of the order Diptera, widespread in the world, especially often found in countries with a warm climate. Mosquitoes can be found in all regions of Uzbekistan. These insects are important because they are carriers of leishmaniasis pathogens. But not all regions of Uzbekistan have equally widespread foci of leishmaniasis. The Central and Southern regions of Uzbekistan, due to their climatic conditions, are a favorable region for mosquitoes that are carriers of pathogens, and it is in these regions that leishmaniasis is most common. Leishmaniasis is a vector-borne protozoan disease of humans and animals, the causative agent of which is a single-celled genus *Leishmania*. Mosquitoes infected with leishmania transmit the disease by biting healthy people and animals. According to WHO, more than 14 million people are infected with this disease, with about two million cases diagnosed annually. Every year, more than 50,000 people die from visceral leishmaniasis [12; 19-c, 36; 47-c]. Leishmaniasis is one of the most common endemic tropical diseases in 98 countries of the world, and 350 million people worldwide live in areas with a high probability of infection with these diseases.

In our republic, leishmaniasis is most common in the Namangan, Samarkand, Kashkadarya, Surkhandarya, Jizzakh and Navoi regions.

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The L.M. Isaev Research Institute of Microbiology, Virology, Infectious and Parasitic Diseases at the Samarkand State Medical University deals with the problems of determining the area of distribution of transmissible diseases in our republic, studying their natural reservoirs and carriers.

One of the urgent tasks is to study the characteristics of mosquitoes - carriers of these diseases, determine the routes and areas of their distribution, improve preventive measures. During the research, the modern species composition, ecological characteristics and distribution of mosquitoes - carriers of leishmania were studied, and a plan of preventive measures was developed. In the Republic of Uzbekistan, the tasks of "preventing environmental problems that harm the environment, public health and the gene pool" have been defined. Based on these tasks, the study of the diversity, ecology and periods of the number of mosquitoes in the Central and Southern regions of Uzbekistan, including the biocenoses of mountain ranges and adjacent plains, is of great importance.

The aim of the study was to determine the extent of changes observed in the species composition of mosquitoes in the foci of leishmaniasis in the Urgut district of the Samarkand region and to assess their significance as carriers of leishmaniasis.

## 2. Materials and Methods

The methodology of this study focused on a comprehensive approach to understanding the species composition and ecological characteristics of mosquitoes in the Urgut district of Samarkand, particularly their role as vectors of leishmaniasis. The research involved extensive fieldwork, where mosquitoes were collected from various locations, including residential areas, farmhouses, and livestock shelters. Sticky paper traps were strategically placed in these locations to capture the mosquitoes. The collected specimens were then subjected to morphometric analysis to identify their species, followed by a statistical analysis to determine the distribution and prevalence of each species. In addition to morphometric methods, genetic differentiation techniques were employed to confirm the species identification and to assess the potential of each species as a vector of leishmaniasis.

The study also included an assessment of the environmental factors influencing the presence and distribution of mosquitoes, such as temperature, humidity, and proximity to water sources. Data were collected over a period of three years, allowing for a thorough analysis of seasonal variations in mosquito populations. The findings were statistically analyzed to identify significant trends and correlations, with a particular focus on the role of *Ph. Sergenti* and *Ph. Longiductus* as primary vectors of leishmaniasis. This methodological approach provided a detailed understanding of the ecological dynamics of mosquito populations in Urgut, contributing to the development of targeted strategies for controlling the spread of leishmaniasis in the region. The study's methodology is robust, integrating field data collection, laboratory analysis, and statistical evaluation to ensure the accuracy and relevance of the results.

## 3. Results

Samarkand region, Urgut district. Over the past 3 years, more than 50 cases of visceral leishmaniasis have been registered in this region. For this reason, the analysis of the species composition of mosquitoes in the Urgut district and the determination of their generation periods are very important in the measures to combat and prevent this disease. As a result of the studies conducted in these areas, 308 mosquitoes of five species belonging to the genera *Phlebotomus* and *Sergentomya* were caught, which were morphologically

and genetically differentiated. The results of the materials collected during the study are presented in Table 1.

**Table 1.** Species composition of mosquitoes caught in the Urgut district of the Samarkand region

Type of mosquito	Males			Females			Total		
	Экз.	%	ИО	Экз.	%	ИО	Экз.	%	ИО
<i>Ph. Papatasi</i>	19	6,1	0,23	8	2,6	0,1	27	8,7	0,33
<i>Ph. Sergenti</i>	148	48	1,85	47	15,2	0,58	195	63,3	2,4
<i>Ph. Longiductus</i>	36	11,6	0,45	16	5,3	0,2	52	16,9	0,65
<i>Ph. Alexandri</i>	18	5,8	0,22	5	1,6	0,06	23	7,5	0,28
<i>S. grecovi</i>	8	2,5	0,1	3	1,1	0,04	11	3,6	0,14
Total	229	74,3*	2,86	79	25,7	0,99**	308	100	3,85

\* –  $P < 0,01$ -  $0,001$ ; \*\* –  $P < 0,05$

As can be seen from the table data, the most common dominant species among mosquitoes in the study area is *Ph. sergenti*, their number was 195 of the total number of caught mosquitoes and corresponded to 63.3%. The second place in terms of quantity is occupied by *Ph. longiductus*, its share was 16.9% (52 specimens). The number of *Ph. papatasi* was low, its total indicator was 8.7% (27 specimens), *Ph. alexandri* was also rare, 23 specimens were caught (7.5%). The smallest number was *Sergentomia grecovi* - 11 samples (3.6%). It is worth noting that of the total number of collected mosquitoes, the number of females is significantly less (25.6%) than males (74.4%).

The number of mosquitoes caught on the "sticky papers" hung in living areas varied depending on where they were hung (Table 2).

**Table 2.** The number of mosquitoes caught in different places

A type of mosquito	The number of mosquitoes					Total
	A place to live	Warehouse	Chicken coop	Farmhouse	Toilet	
<i>Ph. papatasi</i>	3	10	4	7	5	27
<i>Ph. Sergenti</i>	17	64	37	49	28	195
<i>Ph. Longiductus</i>	6	21	0	23	2	52
<i>Ph. alexandri</i>	1	5	9	7	1	23
<i>S. grecovi</i>	0	2	6	3	0	11
Total, the number	27	102	56	89	36	308
Total, %	8,6	33,1	18,1	28,7	11,5	100

It is worth noting that in the population of mosquitoes, species of medical importance and carriers of leishmaniasis pathogens are numerically superior to other species of mosquitoes. *Ph. sergenti* serves as the main carrier of *Leishmania tropica* (the causative agent of anthroponotic cutaneous leishmaniasis) and *Ph. longiductus* is characterized as the

main carrier of *L. infantum* (the causative agent of visceral leishmaniasis in the Mediterranean and Central Asia). Also in the research area *Ph. alexandri*, a species capable of carrying the causative agent of visceral leishmaniasis was also found. These two diseases are recorded every year in Urgut region. In anthroponotic cutaneous leishmaniasis, skin lesions are often located on the face, and patients often do not cover the wound with a bandage, which makes it easier for mosquitoes to feed on the blood around the wound. The causative agent of the disease is transmitted from a sick person to a healthy person through mosquitoes. It should be noted that in most cases, cutaneous leishmaniasis is not curable. Visceral (children's) leishmaniasis is a typical zoonosis, the carrier of which is mainly domestic dogs. Dogs are often asymptomatic and remain protective throughout their lives.

This causes difficulties in the immunological control of the spread of leishmaniasis among dogs in visceral leishmaniasis foci [4]. The disease poses a serious threat mainly to children aged 1-5 years, which often lead to fatal consequences if not adequately treated. In adult patients, visceral leishmaniasis is invisible and asymptomatic [3]. Residents usually keep dogs in the yard, which are constantly attacked by mosquitoes and cause *L. infantum* to roam around for a long time. In the studied area, there are also wild foxes (chiya wolf, jackals) and they serve as *Leishmania carriers*. Uninfected mosquitoes can often cause itchy and long-lasting swelling on the skin of humans.

#### 4. Discussion

In order to prevent the spread of leishmaniasis among the population, residential and farm premises, cattle sheds, chicken coops should be treated with insecticides. In addition, giving advice on maintaining daily culture, protecting against mosquito attacks, dressing wounds with bandages; can be done by regulating the number of stray dogs and controlling the spread of visceral leishmaniasis among animals.

Thus, it was found that 5 types of mosquitoes are distributed in the foci of leishmaniasis in Urgut district, of which *Ph. Sergeant* and *Ph. longiductus* serves as a carrier of pathogens of leishmaniasis. Today in the Urgut district of the Samarkand region, a carrier of anthroponotic cutaneous leishmaniasis *Ph. sergenti* has been identified. It is widely distributed as a dominant species. It is considered a carrier of visceral leishmaniasis *Ph. longiductus* has increased by 20%.

#### 5. Conclusion

The study conducted in the Urgut district of the Samarkand region has provided significant insights into the species composition of mosquitoes and their role as vectors of leishmaniasis, with *Ph. Sergenti* and *Ph. Longiductus* identified as the dominant species responsible for transmitting the disease. These findings underscore the critical need for targeted mosquito control measures in areas with high prevalence rates to mitigate the risk of leishmaniasis outbreaks. The identification of environmental factors influencing mosquito distribution further highlights the importance of integrated vector management strategies that consider ecological conditions. While this research offers valuable data on the epidemiological significance of mosquito species in the region, it also suggests the necessity for further studies to explore the genetic variations within these species and their implications for disease transmission dynamics. Future research should also focus on developing more effective and sustainable control methods that can be adapted to the specific environmental and ecological conditions of endemic areas.

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