Original Article

Dynamics of Occurence of Larvies of the Blood-Sucking Mosquitoes Anopheles in Various Water Bodies of the Surkhandarya Region of Uzbekistan

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DOI: 10.47750/pnr.2022.13.S08.304

Abstract

The article contains materials on the study of the influence of water factors on the species distribution of the number of larvae of the mosquito of the genus Anopheles in various water bodies of the Surkhandarya region.

Keywords: Reservoir, River, Spring, Lake, Blood-sucking Mosquito, Malariogenic Characteristic.

INTRODUCTION

The role of blood-sucking mosquitoes in different ecosystems and therefore it is very difficult for a person to develop relationships with them in relation to protection from them and regulation of their populations. On the one hand, mosquitoes are an important component of almost all terrestrial ecosystems and play a significant role in the movement of substances along food chains. On the other hand, their massive attack on humans and animals causes a negative value as bloodsuckers and carriers of pathogens of many diseases. Thus, annoying attacks of mosquitoes interfere with normal work and rest of people (Shtakelberg, 1937; Sazonova, 1959; Gutsevich et al., 1970, etc.).

Malaria can spread when three factors exist simultaneously in a particular region:

1. The presence of mosquitoes - carriers of the causative agent of malaria.
2. The presence of patients with malaria or parasite carriers.
3. The presence of sufficient temperature for the development of the causative agent of malaria in the body of a mosquito (Gornostaeva, Danilov, 1999).

According to the malariogenic characteristics in Uzbekistan, there are 8 species of malarial mosquitoes, of which 4 species (An. superpictus, An. pulcherrimus, An. maculipennis, An. artemievi) are the main ones and 4 more species (An. martinius, An. hyrcanus, An. claviger, An. algerensis) as minor vectors. Currently, only 4 species (An. superpictus, An. pulcherrimus, An. hyrcanus, An. claviger) are distributed in the Surkhandarya region. It is also interesting that the first three species are found in all areas of the region, and An. claviger only in 4 (Baysun, Denau, Uzun and Shurchinsky districts). These mosquitoes, depending on various circumstances, may represent an epidemiological hazard to one degree or another. Female mosquitoes of the genus Anopheles lay single eggs on the coastal part of the water surface of open reservoirs; the duration of egg and larval development depends on the temperature regime of the water. The larval phase of development of a mosquito of the genus Anopheles, as well as other fam. Culicidae, has 4 growth stages.

Reservoirs in which larvae of blood-sucking mosquitoes live are chosen by females for laying eggs. Female mosquitoes can fly considerable distances when choosing a water body and test the water at potential oviposition sites using chemoreceptors. Each species has its own requirements and preference criteria, which may change in different seasons of the year.

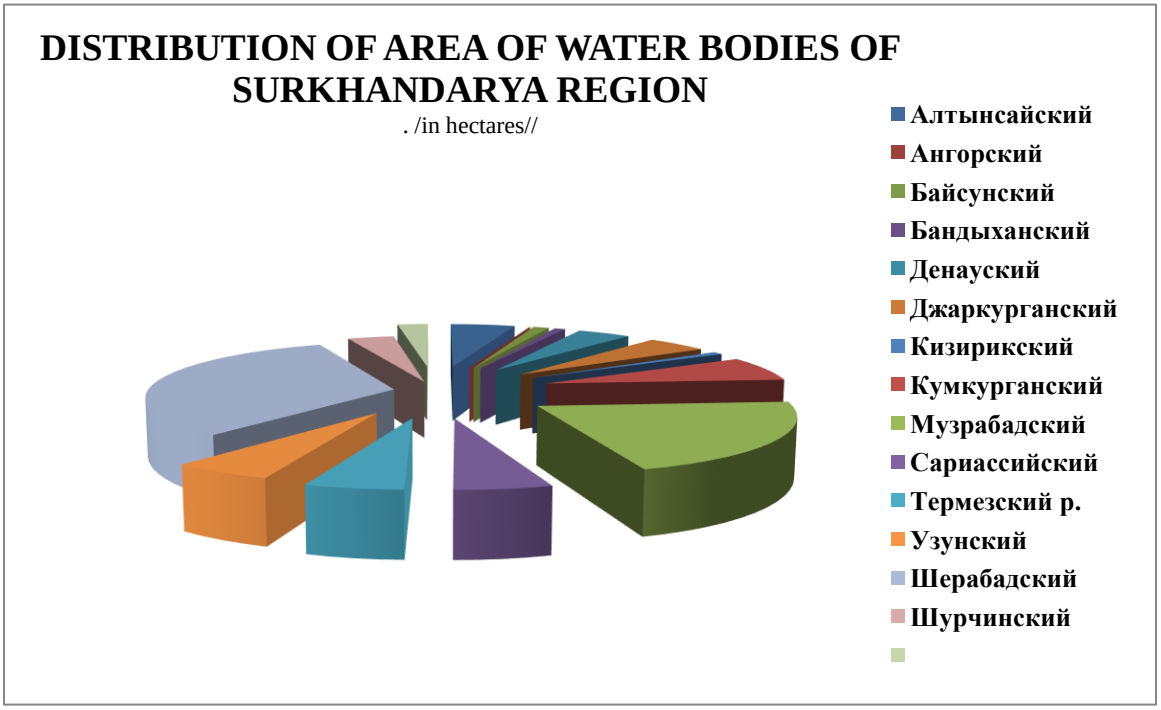
Due to the type and nature of water bodies, mosquito larvae inhabit different biotopes at different times. A larger number of blood-sucking Anopheles mosquitoes in the spring choose small-sized water bodies with good warming, focusing primarily on water temperature. Often these are puddles of a temporary nature, formed as a result of melting snow and as a result of precipitation. The small size of these reservoirs determines their hyperthermia, which also affects the rapid appearance of the thread.

Many temporary reservoirs dry up from the second half of June until the end of summer, so only the first generation has time to go through the development cycle in them. In summer, representatives of the Anopheles mosquito occupy various temporary

artificial places where water accumulates, where favorable conditions are created to maintain high biodiversity. Reservoirs protected by vegetation from the wind are more favorable for the larvae of this genus of mosquitoes, since there is a substrate for attaching the larvae and there is no strong excitement that can wash away the larvae and interfere with their breathing. For example, mosquitoes of the species An. superpictus are able to live with a weak current. In large reservoirs, larvae are found only near the coast, and in small reservoirs with vegetation, they can spread over the entire area. Only a small number of species like An. claviger and An. plumbeus are capable of living in small temporary water bodies without vegetation.

Taking into account these criteria, there is a great interest in the study of the existing reservoirs of the region. In the Surkhandarya region, as of 01.01.2022, there are only 6201 units in 6 types of reservoirs, which occupy a total area equal to 16945.3 hectares, in 23.5% (3973.2 hectares) of them Anopheles larvae are found. Of the total area of reservoirs, 17.3% falls on reservoirs such as large stagnant reservoirs (swamps, lakes, quarries, reservoirs, reservoirs, old channels, backwaters, floodplains) in which 1079.4 ha with Anopheles larvae; 10.7% for flowing water bodies (irrigation network, canals, ditches) in which 277.8 ha with Anopheles larvae; 38.9% of the Collector (drainages, prefabricated discharges, zovurs) in which 893.5 ha with Anopheles larvae; 8.5% of floodplains (sai, streams, springs) in which 173.8 ha with Anopheles larvae; 1.3% of lakes (ponds, houses, pools, fountains, settling tanks) in which 9.6 ha with Anopheles larvae; 3.1% shallow reservoirs (wells, pits, puddles, treatment facilities, cellars with water, barrels) in which 125.5 ha with Anopheles larvae and 20.1% rice fields, in which 1413.6 ha with Anopheles larvae (Fig.one).

In spring and summer floods are noted from May to mid-July, then the rivers begin to quickly and strongly become shallow, in addition, flowing in pebbles, they lose a lot of water. Floodplains of mountain rivers with many spring inclusions in places form swamps overgrown with reeds. Usually during the flood period, these places are covered with water. In the second half of summer, water from the rivers is completely collected for irrigation of agricultural crops. In channels, water usually lags behind only in depressions. Small reservoirs overgrown with green filamentous algae are breeding grounds for a huge number of mosquitoes.



Picture No 1: Diagram of the distribution of areas of water bodies in the context of the districts of the Surkhandarya region as of 1.01.2022

In the villages, the channels of the Sherabad River until the beginning of July were unsuitable for settlement by mosquito larvae due to high water content, a sharp fluctuation in the water level at its low temperature (6-10 ° C). The height of the location of the points is 1100-2000 meters or more above sea level. From the middle of summer, the decrease in water in the rivers led to their partial or complete drying up, which contributed to the formation of numerous, mostly small, reservoirs in the channels, fed by water infiltration from the ongoing underground flow. Such reservoirs quickly became places of mass breeding of An.superpictus larvae and a moderate amount of An. claviger.

In the deep gorge of the mountainous regions, swamps with poor above-water vegetation were occasionally encountered. In such reservoirs, larvae were also found in large numbers (more than 1000 larvae per 1 m^2). In the spring swamps, only An. claviger.

In the foothill part of the region, they were covered by a route survey. Thus, in the village of Pashkurt (Sherabad district) and its environs, many An.superpictus larvae were found in the puddles of the sais floodplain, and in small springs - An. claviger. In some places in these reservoirs, a small number of An. hyrcanus and single An. pulcherrimus.

METHODS

In the vicinity of the city of Termez, there are large areas of reservoirs, which are a favorable breeding ground for malarial mosquitoes.

The studies were carried out in the most epidemiologically significant period of generation of the mosquito of the genus Anopheles (May-July). Anophelogenic reservoirs of the region were surveyed, including channels, ditches, settling tanks, streams, ponds, lakes, puddles and quarry pits. In total, various reservoirs were surveyed on an area of 200 ha, which corresponds to 1.2% of the total area of the available reservoirs in the region (relative to 16945.3).

The number of mosquito larvae of the genus Anopheles and the anophelogenic area of water bodies were counted in accordance with the generally accepted method.

Surveys of reservoirs were carried out taking into account the period of development of larvae and the phenology of adult mosquitoes on the determinants indicated in the manual (Shcherban Z.P., 1991). Particular attention is paid to shallow, unshaded stagnant or low-flowing water bodies rich in submerged vegetation, as well as with a bottom covered with fallen leaves.

The collection of larvae and pupae is carried out according to the scheme of A.V. Gutsevich (1959). From one reservoir, depending on its size, from 10 to 30 samples were taken.

Pre-imaginal phases were counted according to the number of individuals of each phase and stage per sample or per unit area (1 m2) of the water surface. The stage of larvae is determined by the method of A.S. Monchadsky (1952), which is especially convenient in the field.

Control reservoirs are examined periodically every five days. Measure the temperature of the water, while noting possible changes in the nature of the reservoir: partial or complete drying, change of plant forms.

The collection of larvae is carried out with a standard water (20X30 cm) net or plastic utensils. In shallow reservoirs, larvae were caught using a standard net 20 cm in diameter.

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Some of the captured larvae should be used to breed adult insects. For this, cages are used in the form of a wire frame covered with tulle (or gauze) measuring 20X20X20 cm.

To determine the chemical composition of water from mosquito breeding sites, samples were taken into well-corked bottles, after labeling they were delivered to the laboratory.

For the study of mosquitoes, the collection method was also used - fishing "on oneself".

Results and discussion.

To carry out the work, larvae of blood-sucking mosquitoes of the 4th age, mosquito pupae and adults (adults) were collected. Collection of mosquitoes was carried out in open water and in containers. where mosquito larvae were found. The last collections of material were made from the beginning of July to October 2022; mosquitoes were collected not in such large numbers as in previous years.

After conducting laboratory studies and summarizing the collected materials, an analysis was made of the species composition of blood-sucking mosquitoes of the genus Anopheles in the context of the districts of the Surkhandarya region for the period 2017-2021 (Table No. 1).

Table 1. Incidence of Anopheles Larvies in Different Types of Water Bodies of Surkhandarya Region in 2017-2021 (in %)

Types	2017	2018	2019	2020	2021
1. Rice fields	48,2	23,5	13,1	11,2	28,5
2. Wetlands	19,1	3,5	3,1	8,5	17,3
3. Zaurs	12,6	2,3	2,9	4,5	5,1
4. Springs	15,9	0,8	0,88	-	-
5. Houses	5,3	0,4	0,24	-	0,9
6. Ditches, pits	Single	-	-	-	-
7. Fire barrels	Single	-	-	-	-
8. Wells	Single	-	-	-	-
9. Carreras	-	-	-	-	-

A total of 343 individuals were collected, of which An. superpictus 161, An. pulcherrimus 117, An. hyrcanus 65. An. claviger did not come across. An. became the dominant species. superpictus, which accounted for 46.9% of the total collected material, the second place was taken by An. pulcherrimus 33.8% and third place An. hyrcanus 18.9%. Based on these materials, Table No. 2 was compiled.

Table 2. Species composition of blood-sucking mosquitoes Anopheles in the places of collection from various reservoirs of the Surkhandarya region 2022

Names of survey areas	*An. superpictus*		*An. pulcherrimus*		*An. hyrcanus*		*An. claviger*		Total	
	things	%	things	%	things	%	things	%	things	%
1. Oltinsay										
2. Angor										
3. Baysun										
4. Bandikhan										
5. Denau	34	21,1	28	23,9	19	29,2			81	81
6. Jarkurgan										
7. Kizirik										
8. Kumkurgan										
9. Muzrabad										
10. Sariasiya										
11. Termiz	31	19,3	24	20,5	12	18,5			67	67
12. Uzun	12	7,5	6	5,1	1	1,5			19	19
13. Sherabad										
14. Shurchi	28	17,4	21	17,9	12	18,5			61	61
15. Termez city	56	34,8	38	32,5	21	32,3			115	115
Total:	**161**	**100,0**	**117**	**100,0**	**65**	**100,0**			**343**	**343**

CONCLUSION

As shown by studies conducted from 2017 to 2021, rice fields and swamps are most affected by Anopheles larvae, then saurs, and then much less - springs and hauzes, even less - pits, ditches, quarries, wells. In fire-prevention tanks (pools), larvae were found in isolated cases. From the above mentioned, it can be concluded that the weather, climatic and water environmental factors of the Surkhandarya region provide prerequisites for the reproduction of the population of blood-sucking mosquitoes of the Anopheles genus. Although planned preventive work is being carried out on antimalarial measures in the water areas of the region, there are still chances of an increase in the malariogenic situation also due to the use of available water areas for various types of reservoirs. In anophelogenic water bodies, an increase in the abundance of mosquito larvae of the genus Anopheles can still be observed. The ongoing global climate crisis - global warming can also positively affect the growth in the number of malaria foci.

We recommend that specialists involved in these pressing issues, when developing measures to combat malaria, take into account the optimal weather and climate conditions and water factors that contribute to the development of larvae of adult mosquitoes of the genus Anopheles. Since in the studied reservoirs with a temperature regime above the optimal level, the anophelogenic area and the number of larvae are reduced due to changes in the chemical parameters of water, which act as leveling factors. And this leads to an increase in the process of biochemical oxidation of organic substances, as a result, there may be a deficiency of oxygen dissolved in water, which is so necessary for the life of small biological organisms like mosquitoes.

It should also be taken into account that with the globalization of the climate, the evaporation of water from these reservoirs may also increase, as a result of which the level of salt concentration in the water increases, which also negatively affects the viability of Anopheles larvae. The solarization process is another approach to this issue that needs to be addressed in the future.

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