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In our country great attention is given to the agricultural rehabilitation of hot deserts and semideserts. Wide spaces of unused land hide in themselves under the conditions of abundant light and warmth, tremendous potential possibilities.

The use of these natural riches for the benefit of mankind was impossible during the pre-revolutionary period. Only during the time of the Soviets there began a planned irrigation of earlier fallow lands. As B.A. Fedorovitch shows, during the last 20 years in our country there have been irrigated 3 times as many deserts as have been irrigated during the several thousands of years of the existence of irrigation farming in Central Asia. However, all this is only the beginning of an even greater more grandiose work of development of agriculture and industry in the deserts of our country - the riches of which cannot be counted.

The agricultural rehabilitation of hot deserts is unthinkable without special protection of human health under these distinct conditions of raw nature. In order to examine the possibility of existence in the deserts of natural foci of human diseases and to study the conditions of their existence and liquidation - in 1951 and 1952 in one of the greater deserts of the world - Kara Kum worked an expedition of the Academy of Medical Science SSSR (Director of the expedition P.A. Petrischeva - general direction - E.N. Pavlovsky). In this article we present a short review of the work done by the expedition.

The theoretical basis in the work of the expedition was the teaching of the natural foci of human diseases started by Ac. E.N. Pavlovsky.

The basic idea of this teaching is that in the heart of nature untouched by man, there long ago originated and still exist diseases of wild animals - zoonoses - which may during the agricultural acquisition of manless lands - become also diseases of humans.

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To such diseases belong the seasonal encephalitis (tick and mosquito), epidemic tick fevers of bacterial and viral nature, tick recurrent typhus (=relapsing fever), tularemia, leptospirosis, leishmania (skin and visceral), Phlebotomus fever, and others.

At the present time the teaching of the natural foci of human diseases has been fully proved in practice and has obtained a general acceptance. The practical importance of this teaching has grown strongly at the present time - when the acquisition of new territories in our country acquires wider dimensions from one year to another.

The separate points of this theory of natural foci are at present continually complemented by many new data which allow us a more concrete approach to the outline and basis of prophylactic measures. More and more materials are gathered dealing with the landscape epidemiology of transmissible diseases with natural foci, the basic theories of which had been worked out by the Acad. E. N. Pavlovsky in 1934 when there was already observed a quite strong attachment of the various diseases to individual landscape zones. The typical landscape of tick encephalitis proved to be mixed taiga forest with a well developed vegetal cover; for mosquito encephalitis - forest free, greatly humid districts typical of grass mixture or alfa-alfa meadows; the various forms of tick fevers are found in mixed grass, grass-shrub steppe or forest steppe and so on.

The extreme variation of the diseases with natural foci is characteristic of the hot steppe landscape and semi-desert with which are connected the natural foci of Phlebotomus fever, skin leishmaniasis, tick recurrent fever (=relapsing fever), tick fevers and other diseases.

The term landscape zone is being used here in its geographical value - that of a historically composed and closely depending on one another relationship of living organisms - animal and plant - existing within distinct environmental conditions: - a definite form of the relief, character of the soil and definite climatic conditions.

The great practical importance is acquired by the new data on the epidemiological role of the microlandscape and microstations within the limits of this or that landscape. This means that the landscape as a whole does not represent only a single danger to man but that its various sections - microlandscapes in which the pathogenic organisms are being kept as part of the many components of the natural biocoenose - are dangerous. Especially on separate, comparatively small spaces in which the active life and actual preservation of the microfoci of the infection occur.

Most of all such microfoci in nature are the burrows and other shelters of wild animals - the feeders of a tremendous quantity of bloodsucking insects and ticks. These ectoparasites keep up an uninterrupted circulation of the etiological agent of the disease inside the natural focus of the infection.

Apart from any connection with the agricultural activity of humans, the circulation of the disease agent is carried on within the natural focus -

going from a sick animal to a healthy one. When humans appear in nature the distribution of the infection with the subjugation of this new susceptible organism can proceed in two ways: (a) from a sick animal to a healthy man, and (b) from a sick man to a healthy one.

In the epidemiology of diseases with natural foci, knowledge of that specific microlandscape with which the existence of the microfocus of the disease is most closely connected is of great importance. In the investigation of deserts and semi-deserts in Turkmenia - especially in the zone of Kara Kum - as also in other landscapes of our country - such territories can be sharply separated - as they concentrate the majority of the steppe inhabitants (animal) with which the origin and active life of the microfoci of the infection are most closely and constantly connected.

I. Epidemiological Importance of Some of the Microlandscapes in Kara Kum

Since not even the sandy desert landscape appears to be all the same at the first glance it is easy to distinguish within it microlandscapes with the richest and most varied life, where with a great probability we are able to determine natural foci of this or that human disease. Special medical importance is characteristic of the following microlandscapes of Kara Kum: hardened sand with sand-rat settlements and other animals, Uzboi - the valley of an ancient river, scrub forests in the Amu - darya valley, remnants of ancient settlements and burial mounds. We shall shortly review each of these microlandscapes separately.

1. Hardened sands

The vegetation of hardened sands consists of growths of white or sand "saksaul" (Haloxylon persicum), black "saksaul" (H. aphyllum), (Calligonum setosum, C. turkestanicum, C. caputmedusae, C. eriopodum).

Fig. 1. Central Kara Kum. Semihardened sands.

Fig. 2. Central Kara Kum. Colony of the great sand rat among "saksaul" undergrowth Ephedra strobilacea, Salsola richteri and others. (Figs. 1 and 2). In the spring there is green vegetation: sand grass, meadow grass, couch grass - which dries up in the summer.

The localities of hardened sands are richest in the animal world. Here, without exceptions, one finds large sand rat settlements (large, diurnal and red-tailed); here also one finds most frequently the burrows of small marmot (figs. 3 and 4). Of the other mammals in the "saksaul" undergrowth - the following are common: hare and several species of "Tushkanchikov" (transliterated).

Fig. 3. Great sand rat - basic reservoir of the agent of skin Leishmaniasis in Kara Kum; it is a carrier of spirochetes and rickettsia pathogenic to man.

Fig. 4. Small marmot - reservoir of leishmania and spirochaetes pathogenic to man.

Special attention should be given the more easily seen quantity of birds in "saksaul" forests as compared to other microlandscapes of Kara Kum. In the "saksaul" undergrowths in the district of Faraba, in the desert station Repetek and in other places there have been discovered the following birds: desert crow, slavka-zavirushka, slavka-pustynnaia, sinitza bukharskaia, chekany, desert chekan-pilasun, saksaul sparrow, desert cookoo, desert sorokaput, kozodoii "copoka" etc. (Note: the preceding words were transliterated). The majority of the birds nests on the "saksaul" but several fly into burrows and nest there (e.g. rekah).

There are birds who nest primarily in the ancient wells (sparrow). It should be pointed out that during ancient times many birds would fly deep into the wells and would die there from hunger and insufficient water.

Rodent burrows and those of other animals are usually infested with Phlebotomus. In the burrows of the great sand rat and the small marmot in the "saksaul" thickets there live Phlebotomus papatasi, Ph. caucasicus, Ph. sergenti, Ph. sergenti var. alexandri, Ph. munitus var. arpaklensis, Ph. grekovi, Ph. chinensis. In the burrows of the great sand rat there were found hungry and satiated females of the ticks Hyalomma asiaticum, H. detritum, hungry males, larvae and nymphs of the sand species.

Fig. 5. Central Kara Kum. Insect net being stretched over the well opening before the evening flight of insects (a good collection method), and of Ornithodoros tartakovskyi, also the mosquitos - Theobaldia longiareolata, Culex pipiens, Anopheles superpictus, An. maculipennis var. sacharovi.

In five wells situated in the "saksaul" thickets in Repetek district there were found: larvae of Theobaldia longiareolata - in three, larvae of Culex pipiens - in five, larvae of An. superpictus - in two, larvae of An. maculipennis var. sacharovi - in one, larvae of C. pipiens were found both in shallow wells and deep ones - sometimes at the depth of 13 m from the surface. Larvae of Theobaldia and Anopheles on the other hand were found in shallow wells where during the day the water is warmed up to 25-26°C. At the tops of the wells with the use of nets and screws before the evening flight of the insects there were collected males and females of all the species of mosquitos enumerated (fig. 5).

On a sticky paper placed into the depth of the well during the night there were collected Ph. papatasi, Ph. sergenti, Ph. arpaklensis, Ph. grekovi. On examination - the sparrow nests in the wells yielded the ticks Argas reflexus.

It is interesting to observe that in the district of Repetek there exists a large quarry about 4 to 5 meters deep. From this quarry time to time sand has been taken for agricultural purposes. At the bottom of this quarry there was discovered a massed flow of ground waters which formed 35 small shallow water reservoirs among the underbrush. The water fall of the largest pools did not exceed 1m². All 35 pools were infested with An. superpictus in all stages of development. In several cases the number of larvae reached 50 specimens per 1m².

In shallow wells of this zone the numbers of larvae of Th. longiareolata consisted of more than 200 specimens per lm^2 and at one time larvae of An. superpictus were found at the rate of 5-20 specimens per lm^2 . In this case we faced the rare fact of exclusive abundance of mosquitos in practically one populated desert. The mosquitos obtained their blood meal of men and camels in an only section in a small village situated a short distance from the mosquito breeding grounds. The daily shelters of the mosquitos were the burrows and wells and less frequently the buildings of a railroad station.

On another section, situated about 10 km from Repetek, Aedes caspius and Th. longiareolata were rarely found. There were practically no water pools for mosquito breeding and the females found here could have merely migrated from other places.

There are only a few observations on the migrations of mosquitos in waterless desert. However even these comparatively few data which we can use witness the possibility of passive and active migrations of mosquitos over fairly large distances from their breeding places. During several nights in completely waterless places in Kara Kum we were able to attract to ourselves single females of Ae. caspius (spring and summer periods), Th. longiareolata and C. pipiens (summer and fall period). Specially interesting are the findings of E. Korbabev of females of An. maculipennis var. sacharovi. While digging up burrows of the small marmot in October 1951 about 200 km away from the nearest oasis. Not excluded is the possibility that here took place a passive migration of mosquitos from the oasis by a transport since this digging took place in a locality of a standard stop on a passing road. Migrations of mosquitos in Kara Kum are known from the results of our previous investigations in the region of Kelif Uzboi (Petrisheva 1935).

Of great interest is the examination of blood of the sand rats for the spontaneous infection with spirochaetes in the large and ancient colonies of these animals. In the Repetek district the first examination of a great sand rat for spirochaetes was done by us in 1938. The quantity of animals infected with spirochaetes on this section equalled then 3.5%. During the same year sand rats from the Saksaul thickets near Farab had been examined. The spirochaetic infestation varied at different points from 0.2 to 1.5%. If we combine the spirochaetic infestation of sand rats from the deserts and semi-deserts of Kara-Kala, Kyzyl-Artek, Tcharschangi and from other places according to our data obtained from previous investigations then we can observe the exclusively large variation in the spontaneous vectoring of spirochaetes by these animals - from 0.02 to 6.2%. Unfortunately we have been unable to this day to establish any rules or laws governing this to diversified spread of the natural foci of tick spirochaetosis.

In the hardened sands of Central and South-Eastern Kara Kum there are numerous pasture ticks among whom the greatest number is represented by the genus Hyalomma. Less frequently are found ticks of the genera: Rhinicephalus, Haemaphysalis, and Boophilus.

Universally distributed is the tick - Ornithodoros tartakovskyi, which inhabits extremely diversified shelters and burrows of wild animals. In the spring this tick is found in quantities in the burrows of the desert

turtle and continues to live in the covered holes during the entire period of the turtle's hibernation. O. tartakovskyi is also a common inhabitant of sand rat colonies. During the summer this tick crawls into the depths of the rat burrows. Otherwise, one can find it early in the morning on the open sand round the mouth of the burrow which points out the presence of migration of this tick even during the hottest months. It was frequently observed that nymphs of this species can during several hours be attached to the body of a turtle which allows for their passive migration over fairly large distances.

In the burrows of the sand rats and on the rats themselves there were found gamasid mites of five families: Laelaptidae, Dermanyssidae, Hae-
mogamasidae, Macrochelidae, and Parasitidae (A.A. Zemskaya, I.M. Grokhovskaya).

In the districts of hard sands the existence of zoonose foci, of skin leishmaniasis and in places of tick infections - typhoid fevers is undoubted.

The hard sand landscape of Kara Kum as one of the typical landscapes of sandy desert, which is richest in animal life can prove to be the focus of skin leishmaniasis, tick infections, typhus and tick recurrent typhus at one and the same time. It is not without interest to remark that in all these diseases the basic epidemiological role is played by the large sand rat - the most widely distributed animal of the hot deserts and semi-deserts.

2. Uzboi - the valley of an ancient river

Pra-Amu-Darya - was the greatest of the ancient rivers which spread through the lowland territory of Central Asia after this was freed from the tertiary sea. It is supposed that during the second half of the tertiary period Pra-Amu-Darya - flowed over Kara Kum to the ancient Kherzarsk basin - the present Caspian Sea. Later (during the period of last ice cover) Amu-Darya had a tributary from Sary - Kamysch lake - the river Uzboi and flowed into the Khvalin basin at the place of today's Caspian Sea. During the period after the ice period the level of Khvalin basin gradually decreased as a result of which the river Uzboi deepened and deepened its bed. It is supposed that the ancient Amu-Darya by itself covered the Sary-Kamysh gap with its sands and blocked the flow about 2000 years ago. As a result of this, its flow toward the Caspian Sea was interrupted and the delta of the river to the side of the Aral Sea.

Despite the fact that Uzboi ended its existence in prehistoric time the bed of the dead river has been obviously preserved to this day. Over the distance of dozens of kilometers the bed of the Uzboi is covered with water. There exist quite large salt and fresh water lakes and in the spring and summer (less frequently) there can be found micro water reservoirs in places where ground waters have come to the surface. Near several lakes of the Uzboi (Iaskhan, Topiatai) on the right side of the ancient river bed where shore features are represented by an almost overhanging wall - the animal world of the desert is very rich and diversified. Had one not seen it in person it would be hard to believe in such a concentrated and intensive life in the center of Kara Kum.

Many lakes are surrounded with massive growths of "kamyska" (transliterated). In the old river valley there can be found both trees and bushes. The overhanging sculptured shore is ploughed up with numerous burrow - nests of birds and frequent crevicelike shelters - the burrows of the dicobraf. In this corner of green landscape among vast spaces of soft sands there were discovered interesting microstations providing the conditions for the development of a great number of blood sucking insects and ticks (figs. 3-6).

In the shallow water pools, shallow wells and the shallows near the lake shores there breed 14 species of mosquitos including 2 species of Anopheles (table 1).

Most infested with mosquito larvae proved to be wells whose water level varied from 0 to 2 meters distance from the surface. Here bred 8 species out of 14. Very frequently the majority of the larvae and pupae in the wells belonged to the genus Theobaldia; Uranotaenia unguiculata bred mainly among flooded bush growths and in shallow wells found among the thick undergrowths of the shore line vegetation. In strongly blocked water reservoirs prevailed C. pipiens and Ae. caspius.

Characteristic features in the selection of breeding spaces are especially clear in An. hyrcanus [kamyskavye (transliterated) growths in shore shallows] and in Mansonia richiardii [kamyskai (transliterated) growths in water]. Larvae of almost all species of Culex inhabited in force the open, shallow water holes. The widest "diapa zone" in selection of breeding places is found in C. pipiens and Ae. caspius (figs. 6 and 7).

Fig. 6. Collection of mosquito larvae from a well on Uzboi - in the southwestern Kara Kum.

Larvae and nymphs of all species of mosquitos exhibit in Kara Kum a characteristic behavior; during the hottest hours of the day they move to the most shaded parts of the water reservoirs where the temperature of water is 3-6° lower than in the open parts.

When winged mosquitos on the Uzboi are divided according to their biotopes an interesting detail is discovered; the most favorable shelter for the winged males and females of all species - in day time are water wells. Many of the mosquito species use the same wells as their breeding spaces. However, in those cases when there are other shelters near especially if they have sources of food - eg. crevices, semi crevices, nests and burrows - the mosquitos will hide there during the day (table 2).

Practically along the whole stretch of the irrigated part of Uzboi there are distributed marshes and flies. In several places these blood suckers reach large quantities (region of lake Iaskhan, Topiatan, and Molla Kara). They stay during the day in the thick vegetation and also in rodent burrows.

The fauna of Phlebotomus in the region of Uzboi - as in other localities of Kara Kum, does not present any special variation. All the usual species were discovered there: Ph. papatasi, Ph. caucasicus, Ph. sergenti, Ph. sergenti var. alexandri, Ph. chinensis, Ph. grekovi, Ph. arpaklensis.

Table 1

No.	Species of Mosquitos	Type of water reservoir																		
		Open shallows on the lake	Shores overgrown with reeds	Flooded bush-land	Open spaces between reeds	Wells			Water pools at the Shore											
						Distance from soil surface to water in meters	0	2	1.5	0.5	Ground with vegetation	Ground with no vegetation	Stagnant water remnants							
1.	<i>Anopheles hyrcanus</i>	-	+	-	++++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.	<i>An. pulcherrimus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.	<i>Culex pipiens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.	<i>C. hortensis</i>	++	-	-	-	++	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	<i>C. modestus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6.	<i>C. theileri</i>	++	-	++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.	<i>C. mimeticus</i>	++	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	<i>C. pusillus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.	<i>Aedes caspius</i>	++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.	<i>Ae. vexans</i>	++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11.	<i>Theobaldia annulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12.	<i>Theobaldia longiareolata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13.	<i>Uranotaenia unguiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14.	<i>Mansonia richiardii</i>	-	++	+++	-	+++	-	+++	-	+++	-	+++	-	+++	-	+++	-	+++	-	+++
General No. of species		6	2	3	2	5	6	2	5	4	4	3								

Explanation:

- single larva
 + 5-10 larvae per 1m²
 ++ several tens of larvae per 1m²
 +++ 100 and more larvae per 1m²
 - no larvae

Division of winged mosquitos according to biotopes in Uzboi

Table II

Species of mosquitos	Character of the Biotope					
	Thick growth of vegetation above water	Wells	Crevices and semi-Crevices	Burrows nests of Birds	Burrows of sand rats	Deep Crevices in the shore surface
1. <u>Anopheles hyrcanus</u>	+ +	+	-	+	-	-
2. <u>An. pluchertianus</u>	-	+	-	-	-	-
3. <u>Culex pipiens</u>	-	+ + + +	+	-	-	-
4. <u>C. hortensis</u>	-	+ +	-	-	-	-
5. <u>C. modestus</u>	+	+ + +	-	-	-	-
6. <u>C. thaleri</u>	-	+ +	-	-	-	-
7. <u>C. minutus</u>	-	+	-	-	-	-
8. <u>C. pusillus</u>	-	+	-	-	-	-
9. <u>Aedes caspius</u>	-	+ +	+	+	+	+
10. <u>Ae. vexans</u>	-	+	+	-	-	-
11. <u>Theobania annulata</u>	-	+ + + +	-	+ +	+	+
12. <u>Theobania longiarcolata</u>	-	+ + + +	+ +	+ +	+	+
13. <u>Uranotaenia unguiculata</u>	-	+ + + +	-	-	-	-
14. <u>Mansonia richardii</u>	+	+	-	-	-	-
Total of Species	3	14	4	4	3	3

Explanation:

- + single mosquito
- + + 5 - 10 mosquitos 1m²
- + + + several tens of mosquitos 1m²
- + + + + 100 and more
- no mosquitos

This last specie proved to be in masses inside sand rat burrows. In crevices containing dicebraz burrows the most numerous was Ph. papatasi.

In various positions of Uzboi from the nests of the golden hamster were collected mainly Ph. sargenti var. alexandri.

Fig. 7. Sculptured shore of the river Uzboi in the region of lake Iaskhan - ploughed over by burrows and crevices sheltering various wild animals and their ectoparasites.

At the foot of the sculptured shores of Uzboi where there live birds, reptiles, hedgehogs and dicebrazes, also frequently bats - there was found a fairly great number of ticks of genus Ornithodoros. The dominating species proved to be O. tartakovskyi and O. papillipes was rarely found. Sharp seasonality can be seen in the quantity of ticks collected. At the end of May and beginning of June, ticks of genus Ornithodoros were found only singly away from burrows. In the same locality at the end of September and beginning of October the ticks covered in quantities the mouths of the burrows and crevices; tens and hundreds of larvae, nymphs and adults crawled out of the shelters with the aid of short "cobek"?. Along with Ornithodoros in the burrows of wild animals (hedgehog, turtle, mole dicebraz, etc.) there were frequently found ticks of genus Hyalomma and - less frequently - of genus Rhipicephalus.

In the region of the lakes Iaskhan and Topiatan - A.A. Zemska discovered 11 species of gamasid mites.

Natural foci of human diseases in the Uzboi region

The presence of skin leishmania infection among school children of the livestock kolkhoz situated close to the lake Iaskhan - easily points out the existing zoonose foci of this disease (investigations of N.F. Rodiakin). In the neighboring sand landscapes A.P. Kriukova and M.A. Schoschina established highly active zoonose foci of skin leishmaniasis not only on the basis of examination of school children of the livestock kolkhoz but also by examination of mosquitos leaving the burrows of the great sand rat. The general percentage of infestation of the mosquitos with Leptomonas reached 30-31% on the average.

From the ticks of genus Ornithodoros collected in the region of the lake Iaskhan - there were isolated spirochaetes pathogenic to man.

3. Forests of Amu-Darya valley

Away from the mountains, the Amu-Darya flows for a distance of 1036km through even, flat territory of the sandy deserts of Kara Kum and Kyzyl Kum. It flows through a valley composed of characteristic soils. The part of the valley immediately next to the river is covered with dense - majority tree and bush forest - the so-called "Tugai". In several places there are old, dried up "Tugai" from which the Amu-Darya has been markedly removed and which she stopped to supply with abundant water. These represent the once rich vegetation growing on the original banks of the river.

The basic plants composing the "Tugai" are several species of *Tamarix*, *Turanga*, "gxcuga", several species of willows and other trees and bushes. Abundant growths are formed at various places by the more common *Erianthus ravennae* etc. In sections less covered with these trees there can be found large space covered with *Sarcocolla spontanea* part of which is used for industry.

The trees and the bushes grow in junction with reeds and trostnikom (transliterated). In many spaces the branches of the plants are densely surrounded with liana-like climbing plants, e.g. (*varanchem acutum*, *Calystegia sepium*, *Clematis orientalis*).

Frequently on the fairly great distance going down along Amu-Darya the plant relationships both in their mass and the territory they cover - compose the present jungle forests where one cannot travel without the aid of a hatchet (Figs. 8 and 9).

The abundance of shade, water and humidity form in the "Tugai" an individual microclimate and animal interrelationships. Here is already a slightly different fauna of mammals and birds, slightly different complexes of bloodsucking ectoparasites and vectors of human diseases. Frequently and presently one may see here the reed "kota"; earlier tigers roamed these regions. In drier places one can meet the jackal, fox, the narrow tooth rat, hare, and other large ungulates and bears are common here. More richly represented here is also the bird community: pigeon, sorokoput (transliterated), remez, (transliterated), sparrow, seroka (transliterated), pheasant, and other representatives of the feathered kingdom - in habit the numerous feed shelters in the unpassable parts of the Tugai forest.

Fig. 8. In the "Tugai" forests of Amu-Darya.

Fig. 9. "Tugai" vegetation in the bed of Amu-Darya - typical localities for *An. hyemalis*, *Aedes caspius* and *Ae. vexans*. Near rivers and lakes surrounded with rich vegetation there are found the nests of the wild water fowl. Of the blood sucking insects most widely distributed here are again mosquitos, which become in places a constant trial to man and animals and interrupt both work and relaxation.

In both the spring (snow) and the summer (icecover) flood the whole belt of the Amu-Darya valley is turned into spacious - according to territory taken up - breeding spaces for *Aedes caspius* and *Ae. vexans*; less frequently for *Ae. detritus*. In the more open mud territories, in small isolated puddles, holes and shallow wells, in pipes used to measure the level of ground waters - there breed *Theobaldia longiareolata*, *Th. annulata* var. *subochrea* and *Culex pipiens*.

From other species of mosquitos in the "Tugai" zone there are found - though not in quantities - the following: *An. superpictus*, *An. pulcherrimus*, *An. maculipennis*, *C. theileri*, *C. pipiens*, *Uranotaenia unguiculata*, *Mansonia richiardii*.

All species of mosquitos enumerated live in the Tugai forests during a complete absence of man. The feeding of the mosquitos - including those of

genus Anopheles is done only on wild animals. Any appearance of man in the "Tugai" forests aids in concentration of many species of mosquitos in the close vicinity of this new and larger source of blood.

Attention is attracted also by the fairly frequent finding of mosquitos inside the burrows and shelters of wild animals and in the various crevice-like holes (table 3). Especially high quantity of mosquitos was determined by us inside deep holes and cracks in soft ground - which occurred due to the result of flow of atmospheric and flood waters. The majority of these shelters over many others is due to the fact that in the depths of shaded, washed off ground there the humidity is preserved fairly long due to the great filtration of water into the thick, surrounding walls during the period of the great flows of the spring and summer flood waters. Most frequently these shelters are used by a mass of mosquitos belonging to Ae. caspius and Th. longiareolata.

However, it should be remarked that the frequency of finding and completeness of infestation of the natural biotopes with mosquitos depend on the nearness of breeding places of this or that species, on the time of the year, the type of the biotope itself, on the abundance and activity of the various species of mosquitos, etc. Interesting is the fact that many species of mosquitos remain during the day in the thick, vegetal growths if these have sufficient shade and shelter from the cross movements of the air. Greatest numbers in the vegetal growths reach An. hyrcanus, Ae. caspius, Ae. vexans, C. modestus.

Usually many species of mosquitos inhabit those natural biotopes (burrows of jackals, deep crevices with reptiles and bats) in which there is prey on which they can suck blood. Apparently these biotopes are used actively by the mosquitos not only as shelters from the heat of the day but also as feeding places.

In all probability, the majority of the natural biotopes enumerated is also the place of winter hibernation for the many mosquito species of the genera Anopheles, Culex, and Theobaldia.

In the "Tugai" growths there are found marsh flies which reach the greatest observable numbers in the lower basin of Amu-Darya. Their breeding spaces appear to be the shallow mud-flats in places of high level of ground water. Their larvae are found also in shallow, well warmed up wells. The marsh flies are active from May to October inclusive. Their bites are quite severe but due to the presence of other, more easily spotted and long known blood-suckers the population takes the bites of marsh flies in the summer are common in the morning and evening hours. In April, or sometimes in the first half of May and also in October the marsh flies become a nuisance even during the day especially in cloudy weather or within vegetation.

The Phlebotomus flies are distributed comparatively rarely in the "Tugai" only in those cases, when the burrows of the jackal, wolf and fox are placed slightly above the "Tugai" growths and in drier shelters of these animals - Phlebotomus are common. In the burrows of foxes and jackals in "Tugai"

Table 3

The daily shelters of mosquitos in the Turkmen deserts in the presence of constant and temporary mud flats.

Species of mosquitos	Type of Biotope										
	Burrows large sand rat	Burrows of jackal	Holes of wolf	Nests "sazom" parks	Nests of Hamsters	Nests of Bak-tril Barn Owl	Wells	Growth in ices	Washed out holes in soft ground	Creeks in sculped terraces	Thick growths of plants near water pools
1. <u>Anopheles superpictus</u>	/	-	-	/	-	-	/	/	-	/	-
2. <u>An. pulcherrimus</u>	/	-	/	/	/	/	/	/	/	/	-
3. <u>An. maculipennis</u> var. <u>sagharovi</u>	/	/	/	/	/	/	/	/	/	/	-
4. <u>An. hyrcanus</u>	-	/	/	/	-	/	/	/	-	/	/
5. <u>Culex hortensis</u>	/	-	/	/	-	/	/	/	/	/	-
6. <u>C. pipiens</u>	/	/	/	/	/	/	/	/	/	/	-
7. <u>C. pusillus</u>	/	/	/	/	/	/	/	/	/	/	-
8. <u>C. modestus</u>	/	/	-	/	/	/	/	/	/	/	-
9. <u>C. theileri</u>	/	-	-	/	/	/	/	/	/	/	/
10. <u>C. mimeticus</u>	-	-	/	-	-	-	/	/	/	/	-
11. <u>Aedes caspius</u>	/	/	/	-	-	/	/	/	/	/	/
12. <u>Ae. vexans</u>	/	/	/	-	-	/	/	/	/	/	/
13. <u>Ae. detritus</u>	-	/	/	-	-	/	/	/	/	/	/
14. <u>Theobaldia longiareolata</u>	/	-	/	/	/	/	/	/	/	/	-
15. <u>Th. annulata</u> var. <u>subochrea</u>	/	/	/	/	/	/	/	/	/	/	/
16. <u>Uranotaenia uncinulata</u>	/	/	/	/	/	/	/	/	/	/	/
17. <u>Mansonia richiardii</u>	/	/	-	/	/	/	/	/	/	/	/
Number of species	14	11	10	10	7	9	15	24	12	14	8

/ mosquitos were found
 - mosquitos were not found

landscape there were found Ph. papatasii, Ph. sergenti var. alexandri, Ph. chinensis, Ph. grekovi, Ph. arpaklensis. Most frequent and numerous species are Ph. chinensis and Ph. sergenti var. alexandri.

Fauna of ixodid ticks is in "Tugai" forests represented by the following species: Hyalomma asiaticum, Hyalomma detritum, Rhipicephalus turanicus, Boophilus calcaratus. In the holes of the jackal and crevice like shelters in the sculptured shores there were found Omnithodoros tartakovskyi.

During dry years and in cases of fairly early end of feed for livestock in the sandy desert - "Tugai" - are used as pastures for camels and karakul sheep. The animals suffer tremendously at this time from ticks and from mass attacks of mosquitos and Phlebotomus. There are cases of tick attacks on man.

From the reports of hunters, among the animals of "Tugai" growths to specially bad tick infestation are wild kabany (transliterated). One ardent hunter (I.I. Simanov) reported that in the spring of 1951 he caught in the "Tugai" of Dargan-Ata district two young pigs weaned from their mother, on whom there were so many ticks it was impossible to count them. The ears of the animals when cleared of the ticks were completely raw.

Natural foci of human diseases in Tugai landscape

As a consequence of the fact that Tugai are not inhabited by man and are comparatively rarely used by the same we do not possess any specific data on the infection of people with this or that disease when in contact with "Tugai" growths. However the possibility of presence in Tugai of sources of human infection with possible zoonose cannot be excluded.

In the Dargan-Ata district in 1951 we have met a convalescing herdsman who had shortly before taken his sheep into the Tugai and became ill. He himself connected his illness with a bite of a "multicolor" tick (that is the local name for ticks of genus Hyalomma) that has so strongly attached during the night in the subscrotal hollow that he had to call a friend to help him to take it off. On the place of the tick bite there was a small swelling. The herdsman lay quite helpless for 15 days and being very far from the settlement he could seek medical help only later. We have every basis to believe that the herdsman suffered from tick rickettsiosis, the natural foci of which are found in the deserts of the central basin of Amu-Darya.

We tend to connect with the presence of jackals a case of visceral leishmaniasis in a child 12 years old observed by us in 1934 in one of the settlements of Khodzhabask district. The child helped with livestock near the "Tugai" forest and frequently spent the night in the field where after sunset appeared masses of Phlebotomus.

The lower regions of Amu-Darga covered with Tugai may harbour in them natural foci of tulareamia and leptospirosis. In this part of the basin there are many rats and successfully climatized otters.

We believe that with Tugai we may connect even the possibility of rabies if we consider that Tugai localities are especially rich in jackals which usually visit the near by settlements.

The "Tugai" forests represent the most interesting interrelationships between the plant and animal world in the presence of abundant water. The Tugai represents a tremendous contrast when compared with the neighboring, spacious landscapes of waterless, sandy desert. In the rehabilitation of the deserts the animal world of "Tugai" forests may not only obtain a wide distribution in the irrigated desert but it also may bring more than one zoonose into the settlements. Because of this great attention should be paid to the study of the epidemiological importance of the Tugai belt.

4. Remnants of Ancient Settlements

During the course of examination of the lands, once irrigated by the waters of the great currents of the Delta of Amu-Darya - Dandana and Daria-Lyka, and during the investigation of Kuria - Urgentchesk district, of several ancient fortress walls in Kharaspa, of Khivin oasis and of other places we have always found blood sucking insects and ticks. Frequently the ruins of ancient settlements are situated at a distance of several tens of kilometers from today's settlements. The remnants of once magnificent buildings are represented by piles of fallen bricks or by formless mounds the remnants of mud walls - all half way buried by the sand.

Fig. 10. Khazarasp. Ruins of ancient fortress in the sands of Zaunguz Kara Kum. Habitat of various ectoparasites of wild animals and man.

Along with this we have examined many houses, Minarets Mansolea the architecture of which was fairly well preserved and represented lively pictures of the ancient culture.

In the condition of soft sand desert these ruins - without an exception are the constant or temporary shelters of various representatives of the animal world. The lower parts of the ruined soil walls, fallen structures half covered with sand - all has been subjected to the destructive hand of time. In the soft ground jackals dig their holes - also foxes, sand rats, marmots, turtles and other animals. Many wild animals especially birds find shelter among the ruins under stones and walls. Here are frequently formed crevice-like shelters where many animals, birds and reptiles find protection from the glare of the summer and the cold of the winter. Frequent inhabitants of the ruins are predatory nocturnal birds - Bactri barn owl and filin (transliterated).

For some animals there exist finished shelters inside the ruins - other animals build there independently; the softness of the ground makes it easy to burrow. A sharp change of the conditions of life in open nature of the deserts causes the usual concentration of animals among the ruins. As a rule on the territory cities half covered with sand there are formed quite independent biocoenoses. (Figs. 10 and 11).

The accumulation of various wild animals among the ruins of ancient buildings does in its turn cause a local concentration of blood sucking insects and ticks. Frequently the ruins of ancient fortresses have many such small shelters that these in their microclimate appear to be to a degree the analogues of crevices, placed deep in the ground under overhanging rocks,

in submountainous and mountainous sections. In such biotopes concentrate both the most varied representatives of the world of mammals, birds and reptiles and also their most numerous ectoparasites - bloodsucking insects and ticks. In both the ruins of Staryi Merv a castle near Bairam - Ali and the ruins of the ancient Mansolea of the Sultan Tekesch in Nadzhin addin Kurba in Kunia - Urgentch and in many other of the remnants of ancient human settlements there is found the tick Ornithodoros papillipes - the classical vector of tick recurrent typhus.

Fig. 11. Ruins of the ancient city of Anau, half covered with sand. Habitat of mosquitos, ticks and other vectors of human diseases. As has been already remarked in the works of Ac. E.N. Pavlovsky the findings of this tick the immediate reservoir and vector of spirochaetes pathogenic to man - in places of ancient human settlements - carry us unwillingly to those times so far removed from us when on the presently fallow lands existed large settlements and cities. There is no doubt about the fact that in the removed past the incidence of tick typhus among humans could have had a greater distribution and that the tick O. papillipes apparently was in the settlements as the common ectoparasite of man - living on farmed territory. This is witnessed by the fact of the discovery of the ticks in all the examinations of the remainders of the ancient settlements of man. There is observed a specially sharp detail: the tick O. papillipes sharply keeps to the territory of the ancient settlements themselves or in their close vicinity; in the landscape untouched by man both today and in the past this tick is found to be exclusively rare representative. On the contrary O. tartakovskiyi is present in masses on virgin lands and penetrates into the zone of settlements long time abandoned by man. (Figs. 7-9).

In the ancient ruins Phlebotomus flies appear to be the constant inhabitants. In some cases they fly here only to obtain a blood meal in other they find breeding spaces among the broken architecture and also daily and winter shelters. We were able to observe that in many cases - when no mammals inhabit the ruins the Phlebotomus flies feed only on the blood of reptiles and birds. (Table 4).

The presence of Phlebotomus in the ruins of ancient buildings is completely determined by their nearness to the flies' breeding places. Thus, for instance in Kaganovitchesk district (Tchardzhousk province, Turkmen SSR) all the shelters inside the fortress had been up to 1938 inhabited by mosquitos including An. superpictus which bred in the fortress well always filled with water. On the other hand in the ruins of Anau - where there were no near waters or mud sections practically no mosquitos were found or they flew here in small quantities.

5. Mounds

Practically in each of the districts of the Amu-Darya basin one can find elevated sections of hill like mounds. Usually one can spot them either at the border of an oasis and sandy desert or on irrigated territories. These mounds are usually composed of mud and soil and are often basically made of peat. For the epidemicologist these mounds represent a special interest since they represent small sections of the wild nature untouched by human activity. Most frequently they are spots of unopened ground not suitable for irrigation due to their relief.

The species of *Phlebotomus* found in the ruins of human settlements in Turkmenia.

Table 4

Location of the ruins of ancient settlements	Species of <u>Phlebotomus</u>											
	<u>Ph. papatasi</u>	<u>Ph. sergenti</u>	<u>Ph. sergenti</u> var. <u>alexandri</u>	<u>Ph. caucasicus</u>	<u>Ph. chinensis</u>	<u>Ph. major</u>	<u>Ph. arpaklensis</u>	<u>Ph. grekovi</u>	<u>Ph. sumbaricus</u>	<u>Ph. clydei</u>	<u>Ph. squamipleuris</u>	<u>Ph. sogdianus</u>
Kunia-Urgentch	+	+	-	+	+	-	+	+	-	-	-	-
Ilialy	+	+	+	+	+	+	-	-	-	-	-	-
Bairam-Ali	+	+	+	+	+	+	+	+	+	+	+	-
Mary	+	+	+	+	+	-	+	-	+	+	+	-
Kaganovitchesk	+	+	+	+	-	+	+	+	-	+	+	-
Anay	+	+	-	-	-	+	+	+	-	-	+	-
Karabekaul	+	+	+	-	+	-	-	+	-	+	-	-
Tchanschanga	+	+	+	+	+	-	-	+	-	-	-	+

+ Flies were found

- Flies were not found

II. Natural Foci of Human Diseases in Kara Kum

1. Natural foci of diseases spread by Phlebotomus.

Skin Leishmaniasis

Natural foci of skin leishmaniasis of zoonose type are distributed in the southwestern and central Kara Kum up to the Orta-Kyro district. They are always connected with colonial animals - sand rats. The infection ratio of Phlebotomus flies with leptomonad forms of leishmania reaches 30% in some places (Kriukova, Schoschina, Suvorova).

There is observed only a small quantity of Phlebotomus flies in central Kara Kum - beginning at Bala - Ischem and reaching to Orta-Kuin and also in the region of Severnyi Zavod. It is possible that this should be explained by the individuality of the landscape of this part of Kara Kum where there are found only a few spaces favorable to large sand rat colonies. The liquidation of the foci of leishmania is more easy here. From the example of Serny Zavod which we have examined during the summer of 1936 and in 1952 it can be seen that agricultural activity of man can markedly restrain rodents and can "fence off" the communities from diseases.

More intensive zoonose foci of skin leishmaniasis are characteristic of southwestern Kara Kum and also of the semi-desert territories situated down the Kopet-Dag mountain range. In this locality all virgin lands and in part the farmed lands have zoonose foci of skin leishmaniasis.

In the entire zone investigated Phlebotomus flies appear to be the most mobile group of the bloodsucking ectoparasites, capable of a quick concentration round man.

Phlebotomus fever

The question of the natural foci of Phlebotomus fever should be considered as finally decisive despite the fact that not all of the parts of the epidemiological picture of this disease are known. The occurrence of the disease in human contact with untouched landscapes of the deserts and semi-deserts of the livestock - drive districts and also in the portioned landscape of Kopet-Daga appears as an exact proof of the fact that the origin of this disease is connected with wild animals.

Of these, great attention should be paid to birds and possibly reptiles on which frequently feed the flies of these natural foci of Phlebotomus fever.

Epidemiological observations point out the possible participation in the transmission of this disease of all the Phlebotomus species of the group sergenti known in the USSR and also of Phlebotomus from the group minutus. The main vector is Ph. pepatasii.

So far there are not any true cases of Phlebotomus fever infection in Kara Kum that we could regard as infections of local origin. However, this situation does not give us the right to be satisfied - on the contrary it

binds us to be prepared to prevent the formation of the foci of this disease in any of the localities being rehabilitated. In the fauna of Phlebotomus in Kara Kum there are richly represented all the species whose presence in other localities is a condition for the origin of diseases. If it is also shown that in the sandy desert the natural foci of this disease are absent then they may be formed due to the presence of humans in incubative period or having a light case of the disease - which is often characteristic of infections of virus etiology. Actual cases of importation of Phlebotomus fever are frequent in the cities and villages of Turkmenia that have earlier been free of this disease.

One case of importation of the Ph. fever was found even in a small and only recently built settlement in Central Kara Kum. This appears to be the first but unavoidable proof of the necessity of conduct of prophylactic measures not only in the newly rehabilitated territories but also in such settlements used as bases for expeditions into the desert. In ancient foci of Ph. fever a fresh population may become infected and serve as the point of distribution of the disease in districts previously free from it.

2. Natural foci of Diseases transmitted by ticks.

Tick fevers

The presence of tick rickettsiosis in Turkmenia has been first established by us in the dune desert in the lower mountain belt of Kopet-Daga in 1948. Several rickettsial strains were easily isolated from Rhipicephalus sanguineus. At the same time and in the same locality there occurred several cases of rickettsial infection among the people who were the first to work on the wild desert. The strains had been studied for two years; their complete sameness with the strains isolated from blood of humans suffering from tick rickettsiosis from several eastern districts of our country has been established (A.S. Korschunova, Z.M. Zhmaeva). Ticks - the vectors of pathogenic rickettsia have been collected in the semi-desert landscape in the burrows of a jackal, dicobraz, badger (P.A. Petrisheva).

The work in this direction was reviewed by us in 1952 in two districts where in the preceding years there have been observed infections among the people, suspected to be rickettsioses (tick).

The basic attention was centered on the study of natural factors of those landscapes of the desert where in the preceding years were registered sporadic infections among the old and the newly arrived inhabitants. The infection was usually preceding by a tick bite - during wood cutting, on animal pasture in the wild nature. Ticks from these places were collected for investigation and yielded quite readily rickettsial strains related to genus Dermacentroxenus (S.I. Kulagin, Z.M. Zumaeva, A.A. Ptchelkina, M.V. Schekhanov).

In another focus where there were infected humans also infected during their contact with nature there were in 1953 isolated several strains of the etiological agents from sick people (from ticks of the genus Ornithodoros and the genus Hyalomma), and also from sand rats and other wild animals (Z.M. Zhmaeva, A.A. Ptchelkina, E.B. Karulin).

Tick recurrent Typhus

Ticks of genus Ornithodoros are universally distributed in the Kara Kum and are the obligatory ectoparasites of various mammals reptiles and now and then - birds. A great quantity of these ticks was found in the burrows of sand rats in central Kara Kum and in burrows of unknown inhabitants in the Uzboi region. Slightly less frequently ticks of genus Ornithodoros were found in the Kazandzhik region and in southeastern Kara Kum. In places with lightly hardened sands the ticks of genus Ornithodoros as a rule, are either absent or are rare. The abundance of ticks is associated with well hardened sands with constant sand rat population. The burrows of these animals are at the same time the usual shelters of a rich world of reptiles (lizards, vipers, turtles). These along with the warmblooded inhabitants of the desert represent a permanent approachable point of blood source for this group of ectoparasites.

In the examination of Kara Kum in 1951 we have isolated from ticks O. papillipes and O. tartakovskyi eight strains of spirochaetes pathogenic to man. The presence of the spirochaetes in ticks was determined also in preceding years. Especially characteristic are the cases of infection with tick spirochaetes of stockmen working in Kara Kum in the lower Tedzhen region.

All the zone of Kara Kum infested with ticks of genus Ornithodoros should be considered as potentially dangerous - due to the tick spirochaetic infection. During the expedition of 1951 in Kara Kum we have witnessed two cases of infection with tick recurrent typhus among persons concerned with soil work.

III. Short review of the examination of the tracks of the Tchardzhon - Kungrad railroad.

In the examination of the tracks of the new railroad between Tchardzhon and Kungrad our main attention was attracted by small settlements, various station constructions that were the first to penetrate the unpopulated region. Of special interest was the solution of the question about those desert dwellers who would be the first to inhabit the rehabilitated territory. The work was conducted with interruptions for several days in such places where in front of our eyes rose up new settlements and in settlements whose past did not exceed 1-1.5 years. The investigation consisted of detailed account of all the fauna of bloodsucking insects and ticks both in the natural stations and the sections inhabited by man. From the analysis of this data we wanted to obtain a more detailed prognosis about that relationship of the separate components of the complex of vectors of human diseases on the rehabilitated sectors which would be formed close to man and subsequently may have a relation to a possible transmission of the zoonose from nature to the new settlements and towns. We have tried to obtain this prognosis as fast as possible so that we could present timely recommendations of prophylactic measures in the new constructions (Figs. 12-15).

Fig. 12. Rocky section of Zaunguz Kara Kum.

Fig. 13. Collection of Phlebotomus flies by nets from the burrows of a great sand-rat colony in Zaunguz Kara Kum.

Along the whole track traversing the uninhabited spaces of Zaunguz Kara Kum - the animal world lacked in richness (fig. 12). However, even here as also in the other sections of sandy desert there could be distinguished "islands" of most concentrated life with remarkable quantity of inhabitants from the world of vertebrate and invertebrate animals. In the burrows of the various sand-rats and also of the marmot, the hedgehog and the turtle here as in the other sections of Kara Kum were collected the following: Ph. papatasii, Ph. sergenti, Ph. sergenti var. alexandri, Ph. caucasicus, Ph. chinensis, Ph. aspaklensis, Ph. grekovi, Ph. ghadei; (2) mosquitos: Ae. caspius, An. superpicus, Th. longiareolata, Culex pipiens; (3) ticks: ixodid, argasid; (4) gamasid and now and then red mites; (5) fleas.

The majority of the species of ticks was found both in the burrow and on the master of the burrow. In many burrows apparently prevailed ixodid ticks - especially their larvae; other species of ticks were found in fairly even quantities. In some of the desert sections Phlebotomus flies or fleas were obviously prevalent over all the other parasites.

The infestation of practically all the wells with mosquitos attracts attention. Due to the absence of open water holes the mosquitos bred sometimes in cisterns with drinking water which were transported there for the supply of the population in the sections of desert completely devoid of water. In shallow, easily warmed wells C. pipiens and Th. longiareolata bred in tremendous quantities. Now and then along with the mosquito larvae there were found the larvae of the marsh flies - which was usually the case of wells in the vicinity of tugai forests and irrigated fields reaching to the territory of wild desert. The marsh flies bred successfully in shallow wells where the water level was not lower than 1m. from the ground surface.

In the rehabilitation of deserts as a rule, there takes place a fairly intensive migration of several arthropod inhabitants of the desert to the farmed territory. Furthermore in those cases when the construction of homes was not finished their base and field houses were infested with flies. (Phlebot.). These insects proved to be not only the most mobile, but also the most annoying group of blood suckers in the desert that has ever pursued man. In the new constructions there were found all the species of Phlebotomus living in the burrows of sand-rats, marmots, turtles and other wild animals.

The common species of insect - parasites and pests of man inhabiting newly settled localities have unbound possibilities of passive migration; these are provided by the railroad, the cars, airplanes and also camel caravans. Migrations of various insects to a new farmed territory were observed both from the desert and from the ancient oasis to the desert. Because of this on newly settled territories (due to the absence of prophylactic measures and sanitary - hygienic habits of the population) there will occur exclusive by quick spread of mosquitos, flies, fleas, and other insects and also several species of ticks.

On the territory of the meteorological station built in Kara Kum about 3 years after the beginning of the enterprise there were found more than 40 species of squantropic insects and ticks. These migrated on a small section

of the rehabilitated desert both from the desert and the oasis situated 120km from the place on which stands the station.

On the ancient flood lands lying close to the contemporary oasis there can be observed a fairly high level of ground waters. This leads to a strong increase in the number of mosquitos - in all manner of works involving the ground in connection with digging of ground for railroads. Because of this all the ancient flood lands situated a small distance down the railraod track were infested with larvae and puppae of blood-sucking mosquitos among which there were found 6 species of malarial mosquitos: An. hyrcanus, An. superpictus, An. pulcherrimus, An. maculipennis var. sacharovi.

During the time of our investigation in June-July 1951 all the territory from Tchardzhen to Ene-Kulievo and also from Pitniak to Urgentch inclusive was abundant in soft water mud flats which originated on the sides of the artificially elevated railraod tracks and were a possible danger in connection with the distribution of malaria on the rehabilitated lands. This condition should be given a special attention on the part of the prophylactic establishments.