

Study of the effect of compositions of mineral oils with ether oils on the mosquitoes

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Accepted for publication: 05 June 2020

The purpose of our study was elaboration of locally applied phytopreparations capable of providing effective protection from mosquitoes. Unique oils of Azerbaijan are rich in naphthenic hydrocarbons, so they are suitable for preparing cosmetic and medical oils. We have obtained cosmetic oils by fully purifying oil distillates from aromatic hydrocarbons in presence of natural and synthetic adsorbents. The composition of purified oil distillates of essential oil, obtained from the plants and their mixtures, has been studied. Though rubbing of the hands with the control oil distillate did not have any result, application of the prepared compositions of oils gave positive results in protection from mosquitoes.

Keywords: Oil distillates of petroleum, essential oils, protection from mosquitoes

INTRODUCTION

There are over 3,000 species of mosquitoes in the world, 500 species of them are malaria mosquitoes. 70 species of these mosquitoes spread malaria and other parasitic diseases among people (Lysenko, 2003).

28 kinds of mosquitoes of 7 species dwell in the regions of our Republic, 7 of them are malaria and 21 are non-malaria mosquitoes (Baghirov and Aliyev, 2012). These malaria and non-malaria mosquitoes can spread various parasitic and infectious diseases, viruses and arboviruses among people.

As a result of the researches, the antibodies to Tyaginya arbovirus from *Aedes vexans* mosquitoes in Sabirabad region (Gaidamowitz, 1968) and from *Anopheles hyrcanus* mosquitoes in Lankaran region were found in the blood of local population (Lysenko, 2003).

In Qyzylaghaj reserve, the Uukuniemi arbovirus was obtained from *Culex* mosquitoes and in addition, antibodies to Sindbis and Tyaginya arboviruses were found in the blood of the local population (Ismailov, 2008).

Also, in 2013, the Sindbis arbovirus was revealed in this zone from *Anopheles Maculipennis* mosquitoes, caught in a non-residential building in Garagurd village of Khachmaz region (Aliyev, 2013).

An.vexans, *C.modestus*, *An.hyrcanus* və *An.maculipennis* mosquitoes can spread parasitic disease - Tularemia in our Republic. *Ahopheles*, *Culex*, *Aedes* and other mosquito species spread Filaria parasites among people (Gaidamowitz S.Y., 1971).

So, because of the need of preparing a local, natural and completely harmless preparation against mosquito in our Republic, we have elaborated a medicine that has an effect in protecting from mosquitoes and that has been tested in laboratory conditions Gurinovich и Puchkova, 2005; Kyazimov, 2005).

MATERIAL AND METHODS

For the purpose of studying the effect of various oils against mosquitoes, the researchers of the Institute of Petrochemical Processes named after

Academician Y.Mammadaliyev prepared the drug preparation, based on combination of White Naphthalan oil with 5 oils (thuja, eucalyptus, rosemary, mint, pine) at certain ratios. The strong bactericidal effect of the preparation was also studied on 4 microbes: *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli* bacteria and *Candida albicans* fungus.

Reagents used in the preparation of compositions:

The quality indicators of the White Naphthalan oil (fraction 260-500°C fraction) corresponds to the table 1 on "White Naphthalan Oil TSh AZ 3536601.246-2016".

The quality indices of essential oils of rosemary, eucalyptus and ordinary pine plants are given in Table 2.

Physical and chemical parameters of preparations used in the preparation of compositions are given in Table 3 "White Naphthalan oil based cosmetic ointments TSh AZ 3536601.264-2018".

Table 1. Quality indices of White Naphthalan oil.

The name of index	Norm	Test methods
External appearance	Transparent colourless homogeneous fluid	According to the 4.2. point of current TSh
Density at 20°C, kg/m ³ , should not be less	860	According to GOCT 3900
Kinematic viscosity at 20°C, mm ² /sec, should not be less	10	According to GOCT 31391
Ignition temperature °C, should not be lower	90	According to GOCT 4333
The amount of aromatic hydrocarbons	There is no	According to GOCT 6994
The amount of resins	There is no	According to the 4.3. point of current TSh
Mass fraction of Naphthene hydrocarbons, with percent, should not be less	97	According to the 4.4. point of current TSh
Acid number to 1 g product, mg KOH	Absent	According to GOCT 5985
Amount of water	Absent	According to GOCT 2477
The amount of acids and solvents, soluble in water	Absent	According to GOCT 6307

Table 2. The quality indices of essential oils of rosemary, eucalyptus and ordinary pine plants

The name of indicators	Rosemary oil GOCT-31791-2017	Eucalyptus oil OKII-91-5120	Ordinary Pine oil OCT-10-81-87
Viscosity, g/sm	0.875-0.905	0.870-0.920	0.868-0.903
Acid number, mg KOH/g, should not be too much	Should not exceed 1	Should not exceed 2	Should not exceed 2
Ester number, mg KOH	6.0-20.0	-	Should not be less than 15.0
Breakdown factor, 20 ⁰ C	1.4600-1.4750	1.459-1.470	1.458 -1.485

Table 3. Physical and chemical indices of preparations

The name of indicators	Norms according to marks			Test methods
	White Naphthalan+ Rosemary oil	White Naphthalan+ Eucalyptus oil	White Naphthalan+ Ordinary Pine oil	
Iodine number, g Y/100 g, should not be more	0.722	1.225	1.177	According to GOCT 2070
Acid number, mg KOH/g, should not be more	Absent	0.02	Absent	According to GOCT 11362
Density, g/cm ³ 20°C, should not be less	0.8619	0.8628	0.8690	According to GOCT 3900
Kinematic viscosity, mm ² /sec, should not be less				According to GOCT 31391
	8.0505	5.0482	5.4306	
	1.5434	1.5849	1.7399	
Ignition temperature °C, should not be lower	75	75	95	According to GOCT 4333
Freezing temperature °C, should not be above	-60°C			According to GOCT 20287
External appearance	Transparent colourless homogeneous fluid			According to GOCT 29188.0 (section 3)

To test the protective effect of the preparations from mosquitoes, researches have been carried out at the Scientific Research Institute of Medical Prevention named after Academician V.Akhundov. The studies were carried out in the way as recommended by the World Health Organization (WHO) and the authors have been added to this method (8).

In order to study the effects of oils on the *Cx.p.molestus* mosquitoes, the larvae and pups of mosquitoes were collected and brought into the laboratory in the water collected in the basement of the building 23 located in the Third Micro district. The delivered larvae and pups were collected and placed in the narrow cages of the desks, and the winged mosquitoes were taken for studies.

While carrying out the experiments, 30-40 *Cx.p.molestus* mosquito females were released into each of the 2 small desktop narrow cages of 30 X 30 X 30 cm. One of the cages has been selected for an experimental study and the other one – for control. The experiments have been repeated 3 times. During the experiment the temperature of the laboratory was recorded.

Oily hand (with essential oil) was included to the one of the cages, whereas oilless hand – to the second cage. The effects of essential oils on the mosquitoes were evaluated by recording the time-frame till they sucked blood. Exposure of the hand to mosquito's contact lasted about 2 h (for experimental hand) and 15 min (in control). The window of the laboratory was covered with black stuff. The results of the experiments are presented in the tables.

RESULTS AND DISCUSSION

As can be seen from the data, the ingredients which contain eucalyptus, rosemary and *Pinus sylvestris* L. oils have stronger repellent effects on mosquitoes.

As can be seen from Table 4, when is used a mixture containing 4% of Thuya oil and 96% of White Naphthalene oil mosquitoes do not approach to humans for up to 4 hours.

As can be seen from Table 5, when is used a mixture 4% of eucalyptus oil and 96% of White Naphthalene oil mosquitoes do not come close to humans for 5 hours.

When is used a mixture containing of 4% rosemary oil and 96% of white naphthalene oil mosquitoes do not come close to humans for 6 hours (Table 6).

When is used a mixture of 4% peppermint oil and 96% of white naphthalene oil mosquitoes do not come close to humans for 2 hours (Table 7).

As can be seen from Table 8, when is used 4% of *Pinus sylvestris* L. Oil and 96% of White Naphthalene Oil mosquitoes do not approach to humans for 6 hours.

On the other hand, our country has large natural resources to obtain *Pinus sylvestris* L., eucalyptus and rosemary oils.

Table 4. The effect of the composition (1) with Tuja (*Thuja orientalis* L.) oil on the *Culex pipiens molestus* mosquitoes.

Mosquitoes's		Temperature of the laboratory, °C	Control to the experiments
Contact time	Sucking blood during contact		Sucked blood during contact
25.08.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	27.0	Sucked blood after 5 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	27.0	Sucked blood after 7 min
12 ⁰⁰ -12 ¹⁵	Sucked blood	27.4	Sucked blood after 4 min
28.08.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	27.4	Sucked blood after 4 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	27.6	Sucked blood after 3 min
12 ⁰⁰ -12 ¹⁵	Sucked blood	27.6	Sucked blood after 6 min
29.08.2017			
9 ⁰⁰ -9 ¹⁵	Did not suck blood	20.0	Sucked blood after 6 min
11 ⁰⁰ -11 ¹⁵	Did not suck blood	20.0	Sucked blood after 4 min
13 ⁰⁰ -13 ¹⁵	Sucked blood	20.2	Sucked blood after 5 min

Table 5. The effect of the composition (2) with Eucalyptus oil on the *Culex pipiens molestus* mosquitoes.

Mosquitoes's		Temperature of the laboratory, °C	Control to the experiments
Contact time	Sucking blood during contact		Sucked blood during contact
30.08.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	27.4	Sucked blood after 6 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	27.4	Sucked blood after 4 min
12 ⁰⁰ -12 ¹⁵	Did not suck blood	27.6	Sucked blood after 4 min
13 ⁰⁰ -13 ¹⁵	Sucked blood after 4 min.	27.8	Sucked blood after 3 min
31.08.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	27.0	Sucked blood after 6 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	27.2	Sucked blood after 5 min
12 ⁰⁰ -12 ¹⁵	Did not suck blood	27.4	Sucked blood after 4 min
13 ⁰⁰ -13 ¹⁵	Sucked blood after 4 min.	27.6	Sucked blood after 4 min
2.10.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	19.8	Sucked blood after 5 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	19.8	Sucked blood after 6 min
12 ⁰⁰ -12 ¹⁵	Did not suck blood	19.8	Sucked blood after 4 min
13 ⁰⁰ -13 ¹⁵	Sucked blood after 10 min.	19.8	Sucked blood after 4 min

Table 6. The effect of the composition with Rosemary oil (*Ros. arinus L.*) on the *Culex pipiens molestus* mosquitoes

Mosquitoes's		Temperature of the laboratory, °C	Control to the experiments
Contact time	Sucking blood during contact		Sucked blood during contact
5.09.2017			
8 ³⁰ -8 ⁴⁵	Did not suck blood	24.0	Sucked blood after 4 min
10 ³⁰ -10 ⁴⁵	Did not suck blood	24.2	Sucked blood after 6 min
12 ³⁰ -12 ⁴⁵	Did not suck blood	24.4	Sucked blood after 3 min
14 ³⁰ -14 ⁴⁵	Sucked blood after 3 min.	24.4	Sucked blood after 2 min
7.09.2017			
8 ³⁰ -8 ⁴⁵	Did not suck blood	24.0	Sucked blood after 6 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	24.0	Sucked blood after 4 min
12 ³⁰ -12 ⁴⁵	Did not suck blood	24.2	Sucked blood after 4 min
14 ³⁰ -14 ⁴⁵	Sucked blood after 4 min	24.2	Sucked blood after 3 min
3.10.2017			
9 ⁰⁰ -9 ¹⁵	Did not suck blood	18.0	Sucked blood after 5 min
11 ⁰⁰ -11 ¹⁵	Did not suck blood	18.0	Sucked blood after 3 min
13 ⁰⁰ -13 ¹⁵	Did not suck blood	18.0	Sucked blood after 4 min
15 ⁰⁰ -15 ¹⁵	Sucked blood after 3 min.	18.0	Sucked blood after 4 min

Table 7. The effect of the composition with Mint oil (*Mentha L.*) on the *Culex pipiens molestus* mosquitoes.

Mosquitoes's		Temperature of the laboratory, °C	Control to the experiments
Contact time	Sucking blood during contact		Sucked blood during contact
12.09.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	26.2	Sucked blood after 5 min
10 ⁰⁰ -10 ¹⁵	Sucked blood	26.2	Sucked blood after 3 min
13.09.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	26.4	Sucked blood after 4 min
10 ⁰⁰ -10 ¹⁵	Sucked blood	26.4	Sucked blood after 5 min
21.09.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	26.4	Sucked blood after 4 min
10 ⁰⁰ -10 ¹⁵	Sucked blood	26.4	Sucked blood after 3 min

Table 8. The effect of the composition with Pine oil (*Pinus sylvestris* L.) on the *Culex pipiens molestus* mosquitoes.

Mosquitoes's		Temperature of the laboratory, °C	Control to the experiments
Contact time	Sucking blood during contact		Sucked blood during contact
28.09.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	24.0	Sucked blood after 6 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	24.0	Sucked blood after 6 min
12 ⁰⁰ -12 ¹⁵	Did not suck blood	24.2	Sucked blood after 5 min
14 ⁰⁰ -14 ¹⁵	Sucked blood	24.2	Sucked blood after 4 min
29.10.2017			
8 ⁰⁰ -8 ¹⁵	Did not suck blood	23.0	Sucked blood after 5 min
10 ⁰⁰ -10 ¹⁵	Did not suck blood	23.0	Sucked blood after 6 min
12 ⁰⁰ -12 ¹⁵	Did not suck blood	23.2	Sucked blood after 4 min
14 ⁰⁰ -14 ¹⁵	Sucked blood	23.2	Sucked blood after 5 min
5.10.2017			
8 ³⁰ -8 ⁴⁵	Did not suck blood	16.0	Sucked blood after 5 min
10 ³⁰ -10 ⁴⁵	Did not suck blood	16.0	Sucked blood after 5 min
12 ³⁰ -12 ⁴⁵	Did not suck blood	16.0	Sucked blood after 6 min
14 ³⁰ -14 ⁴⁵	Sucked blood	16.2	Sucked blood after 6 min

CONCLUSION

As it is shown in the tables, the protective effect of the mixture of White Naphthalan oil with thuja and mint oil against mosquitoes was 2 h during the study. The protective effect of the mixture of eucalyptus oil, rosemary oil and ordinary Pine tree oil against mosquitoes made 5-6 h. Taking into account these data, it is important to study the effect of the mixture of White Naphthalan oil with eucalyptus oil, rosemary oil and ordinary Pine tree oil against mosquitoes in natural conditions.

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Mineral yağların efir yağları ilə kompozisiyalarının ağcaqanadlara hürküdücü təsirinin öyrənilməsi

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Tədqiqatımızın məqsədi ağcaqanadlara hürküdücü təsir göstərən yerli və effektiv fitopreparatların işlənilib hazırlanması olmuşdur. Azərbaycanın unikal neftləri əsasən naften karbohidrogenləri ilə zəngin olduğundan onlar kosmetik və tibbi yağlar alınması üçün əlverişlidir. Tərəfimizdən təbii və sintetik adsorbentlər iştirakı ilə yağ distillatlarını aromatik karbohidrogenlərdən tam təmizlənərək kosmetik yağlar alınmış və onların tərkibi öyrənilmişdir. Nəzarət variantda təmizlənmiş yağ distillatlarının ələ sürtülməsi nəticə verməyə də bitkilərdən alınmış efir yağlarının və onların qarışıqları ilə müvafiq müsbət nəticələr əldə olunmuşdur.

Açar sözlər: Neftin yağ distillatları, efir yağları, ağcaqanadlara təsiri

Изучение влияния композиции минеральных и эфирных масел как отпугивающего комаров фактора

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Целью нашего исследования являлась подготовка и разработка эффективных фитопрепаратов в качестве средств защиты от комаров, оказывающих сильное отпугивающее действие в местных условиях. Поскольку уникальные масла Азербайджана богаты нафтеновыми углеводородами, они подходят для получения косметических и лечебных масел. Нами получены косметические масла путем удаления жирных дистиллятов из ароматических углеводородов с участием природных и синтетических адсорбентов и изучен их состав. Несмотря на то что при растирании рук очищенными дистиллятами масел в контрольном варианте никаких результатов получено не было, положительные результаты были получены в варианте с изученными эфирными маслами и их смесями.

Ключевые слова: Дистилляты масла нефти, эфирные масла, воздействие на комаров