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BIOTOPES OF *AEDES VEXANS* DEVELOPMENT IN THE LONG FLOOD-PLAIN FOREST OF THE DNIPRO RIVER

Досліджено роль різних типів біотопів у формуванні популяцій *Aedes vexans*. Найвища чисельність імаго пов'язана з біотопами, які личинки населяють у середній чисельності. Оптимальна щільність (350–1700 екз./м^2) для розвитку личинок комарів формується у довгозаплавних лісах р. Дніпро.

The aim of the research was to estimate the role of different types of biotopes in a formation of the *Aedes vexans* high ecological valency. The greatest number of *Ae. vexans* mosquitoes procreate in basins with the moderate density of larvae (49.6–70.2 %), less mosquitoes procreate in basins with the high one (15.9–19.0 %). The optimal and effective density for the development of mosquitoes larvae in temporary basins of a long while flooded forest of the Dnipro river is 350–1700 specimens/m^2, that's why it is necessary just to pay attention to them during taking measures on reducing their numbers.

Introduction

Aedes vexans (Meigen, 1830) is one of the most widespread blood-sucking insect in the world. This species is recorded in Nearctic and Palaearctic regions, along African west coast, in the East regions as far as Samoa islands (Horsfall, 1972).

That mosquito has some names in specific literature. In 1830 the original description named it as *Culex vexans*, and in 1904, John B. Smith referred it to *Culex sylvestris*, the «swamp mosquito» [1; 4]. *Ae. vexans* was recognized as the main bloodsucker and transmitter of pathogenic infections in the world [9]. Research of its ecology, without any doubt, is essential.

This bloodsucker became numerous for the last half of the century in the long flood-plain forest of the Dnipro River since the Kakhovsky reservoir was built in 1956. It is still large nowadays [2]. The aim of our study is to assess different types of biotopes in a formation of the *Ae. vexans* high ecological valence.

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Materials and methods

The *Ae. vexans* larvae were got out according to the generally accepted methods in 2001–2002 every ten-day period from April to October [7]. We examined 46 waterbodies, the places of two generations procreation of the polycyclic *Ae. vexans*. Under conditions of irregular distribution of biotopes of the larvae development over the area of the long flood-plain forest of the Dnipro River, the ratio between the basin's area and the high density of larvae, their share in general numbers of *Ae. vexans* population, were taken into consideration. For this purpose, an average density of preimaginal phases of mosquitos' development, was calculated as an average arithmetical mean, separately for each of three groups of basins. The calculations included an effect of unproportionality in some records, carried out in basins with a different density. Absolute numbers of larvae in basins of different groups and in the whole area of the long flood-plain forest of the Dnipro River, calculated as product of an average larvae density and an area of a lot inhabited by them.

Results and discussions

The biotopes of development of the *Ae. vexans* preimaginal phases can be divided, depending on location, illumination and sizes, into waterbodies of the open landscape and forest reservoirs or into permanent and temporary ones.

Permanent basins are coastal shoals of the upper Kakhovsky reservoir, which exist owing to water level change. They areas are from 100 up to 500 m^2. The basins' depth is no more than 1 meter, pH – 6.0–6.7 and a content of oxygen makes up 7–10 %. The following species of coastal hydrophytes were found in these reservoirs: the common reed grass *Phragmites communes* Trin., the narrow-leaved cat's-tail *Typha angustifolia* L., the broad-leaved cat's-tail *T. latifolia* L. and the elodea *Elodea canadensis* Ric. et Mchx. The basin's bottom sediment is presented by the sandy silt or the uliginous sand. According to the level of organic pollution these waterbodies are referred to oligosaprobic ones. In these basins larvae occur within the coastal zone of 1-2 meters width, overgrown with hydrophytes. The depth of 0.2 to 0.5 meters characterizes the places of larvae assemblage.

Permanent waterbodies in the meadows are formed by the ground water flowing out. The basins have sizes from 0.5 to 4–5 m^2, its depth makes up 0.3–0.6 m, the oxygen content is 9–11 % and pH is 7.0–7.3. The basins' bottom is firm and is covered with the last year's grass. *T. angustifolia* and *Ph. communes* grow in the permanent waterbodies. The larvae occupy only 5–20 % of the whole reservoirs' area.

Temporary basins are the rain pools, ground hollows and the shell-holes which area is from 0.7 to 35 m^2. These waterbodies appear in spring after the snow thawing, and in summer after the rainfalls. These pools of the mosquito development dry up very slowly owing to the ground deepening, good proofness from the wind and the adequate opacity. The basins' depth fluctuates from 0.15–0.50 m, its bottom is uliginous, the water is clear and of brown colour, pH makes up 6.0–6.3, the oxygen content averages 2–6 %. Almost no aquatic vegetation is in these waterbodies. Only branches and leaves were on the water surface. Such basins get warmed thoroughly. Algae and representatives of the *Cladocera* and *Copepoda* almost always develop in the waterbodies.

The flood-plain meadows are temporary inundated with the heavy rain in June and July. Their area can reach up to 100 m^2 and the depth – to 0.1–0.3 m, pH is 6.7 and the oxygen content makes up 5–7 %. Basins' bottom is covered with the last year's grass and the *Ph. communis* is presented there. The water in these waterbodies is quite clear and warmed up. The *Ae. vexans* larvae take 50–100 % of the whole area in the temporary basins.

General variations of the density of preimaginal phases of polycyclic blood-sucking mosquitoes depend, first of all, on amount of the season precipitations [3; 8]. Significant

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fluctuations of the mosquitos' density in different basins, but more frequently within one basin, entail the necessity to classify it according to the density level [10].

The studied waterbodies we divided into three groups: with the low (20–200 spec/m^2), moderate (201–1700 spec/m^2) and high (1701–5200 spec/m^2) density (table 1). The relatively low density of preimaginal phases was observed in the large permanent waterbodies, and in the shadowy temporary ones with aquatic vegetation. The high density was common for most temporary basins. In 2001, in the long flood-plain forest along the Dnipro River, the first generation mosquitos' density averaged 1021.2±46.7 spec/m^2, and the second generation made up 1285.5±52.3 spec/m^2. In 2002 it made up 1307.9±45.0 spec/m^2 and 1696.5±76.0 spec/m^2 respectively.

Table 1

Characteristic of the *Aedes vexans* development biotopes in the long flood-plain forest of the Dnipro River

Generation	Larvae density in different basins, spec	Basins number	Records number	Area of basins, m^2		Average larvae density, spec/m^2	Absolute larvae number, spec
				General	Inhabited		
2001							
I generation	Low	5	26	1220.0	156.2	81.9±2.4	12792.8±374.9
	Moderate	7	28	101.5	30.5	561.9±17.3	17137.9±527.6
	High	3	9	2.8	1.9	2420.0±120.5	4598.0±228.9
	Total	15	63	1324.3	188.6		34528.7±1131.5
II generation	Low	9	35	1250.0	175.0	87.0±2.6	15225.0±455.0
	Moderate	7	26	138.0	52.4	1195.5±34.9	62644.2±1828.7
	High	5	15	4.6	4.4	2574.0±119.6	11325.6±526.2
	Total	21	76	1392.6	231.8		89194.8±2809.9
2002							
I generation	Low	5	27	1285.0	167.0	93.1±2.7	15547.7±450.9
	Moderate	8	40	126.0	44.1	835.0±25.2	36823.5±1111.3
	High	5	12	4.5	4.1	2995.8±107.1	12282.8±439.1
	Total	18	79	1415.5	215.2		64654.0±2001.3
II generation	Low	11	50	1386.0	221.8	105.2±3.2	23333.4±709.7
	Moderate	9	34	234.0	98.3	1025.0±30.3	100757.5±2978.5
	High	8	16	6.5	6.2	3959.4±150.5	24548.3±933.1
	Total	28	100	1626.5	326.3		148735.4±4621.3

The analysis of data obtained indicates that most mosquitoes (from 49.6 to 70.2 %) propagate in the waterbodies of the moderate larvae density. These basins occupy 16.2–30.1 % of the inhabited area (fig. 1) in different years and months.

The third basins group of the high larvae density is not of great importance. In 2002, for example, only 15.9–19.0 % of all *Ae. vexans* larvae developed in those waterbodies. According to our observations, the larvae density may fluctuate 1.8-5.8 times in the basins appearing in the same place every year. But the largest density of the preimaginal phases resides in the same basins.

The basins' area of low density is several times larger than the area of others. In 2001 the average density of the *Ae. vexans* larvae made up: the first generation – 183.1±16.5 spec/m^2 and the second generation – 384.8±27.5 spec/m^2. In 2002 the average density of the first generation was 300.4±27.5 spec/m^2 and of the second one – 455.8±34.6 spec/m^2.

Every year the mosquitos' larvae inhabit a certain part of the water surface of permanent basins. This part fluctuates from 14.2 to 20.1 % of the permanent waterbodies' total area. However, the ratio between the areas of low and of high larvae density was different.

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During the *Ae. vexans* preimaginal phases development, their density was not permanent. In large waterbodies the density reduces in due course and owing to the larvae death and expansion. In rapidly drying temporary waterbodies the larvae and chrysalises densities can increase by 2–6 times.

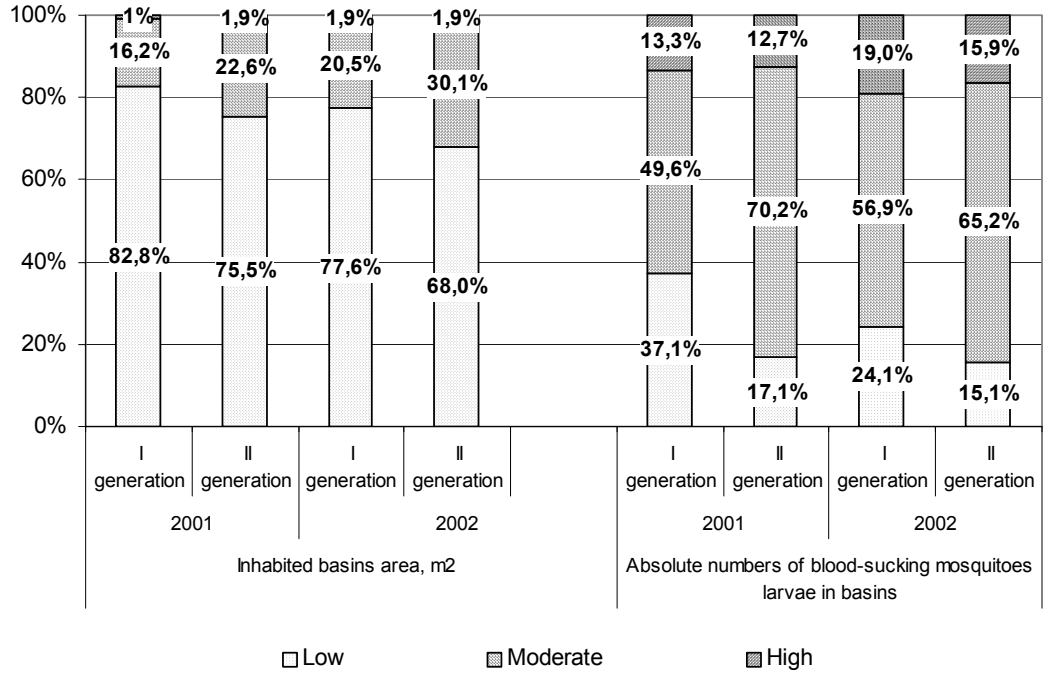

Fig. 1. Role of different biotopes of the *Aedes vexans* development in a formation of their high ecological valency

According to our results, the density 350–1700 spec/m^2 is an optimal for successful development in the basins of the studied region. Such density allows developing the greater amount of the *Ae. vexans* larvae. An increase of congestion to 5,000 spec/m^2 appears only on separate plots and the last days of the preimaginal development. We found that larvae kept together despite the availability of large free space. N. V. Nikolaeva binds this fact with the presence of gregarious behaviour, which is typical for many insect species [8].

It is necessary to pay attention just to these peculiarities of *Aedes vexans* larvae ecology while taking measures on reducing their numbers. Besides, the study of natural biological regulators of the larvae number of mass bloodsuckers is considered to be quite perspective.

Conclusions

Three groups of the *Ae. vexans* development biotopes were marked out in the long flood-plain forest of the Dnipro river: with the low, moderate and high larvae density. Most of the *Ae. vexans* mosquitoes come of the waterbodies of moderate density of larvae (49.6–70.2 %), fewer mosquitoes – of low (15.1–37.1) and of high larvae density (15.9–19 %). The optimal density of the mosquitos' larvae for the effective development is 350–1700 spec/m^2 and it was found in temporary basins of the long flood-plain forest of the Dnipro River. That is why it is necessary to pay particular attention to those waterbodies for reducing the mosquitos' number.

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