UDC 591.5:597.544

Shevchyk L.O.,
Volodymyr Hnatiuk Ternopil National Pedagogical University, Ternopil, Ukraine
Kravets N.Ya.
HSEI «I.Ya. Horbachevskyi State Medical University», Ternopil, Ukraine, Kravetc@i.ua

ECOLOGICAL ANALYSIS OF THE DIVERSITY IN THE ELEMENTS OF MELANIZED PICTURE IN THE INTEGUMENT OF A RED SOLDIER BUG (PYRRHOCORIS APTERUS L.) IN THE URBANIZED ECOSYSTEM OF TERNOPIL

Abstract. *The paper analyzes the phenotypic diversity of red soldier bug larvae in the population of the urbanized ecosystem of Ternopil in terms of its role in entomo-bioindication of its ecological condition. The study was conducted by analyzing four signs of the melanized picture in the integument of a red soldier bug larvae.*

Key words: *red soldier bug, larva, entomo-bioindication, phenotypic diversity.*

Introduction. Monitoring the ecological state of the environment has a pronounced regional character and reflects the individual characteristics of the analyzed biota. Such studies help identify disturbances in ecosystems caused by the transforming influence of anthropogenic factors at early stages of their occurrence.

Actually, entomo-bioindication belongs to such research methods and it is carried out using the incidence of different phenes of melanized picture in the integument of a red soldier bug.

Objective: to study phenotype diversity of red soldier bug larvae in the population of the urbanized ecosystem of Ternopil.

Materials and methods. Population insects sampling was performed in their natural habitat. We selected the species with varying degrees of anthropogenic load. The sample consisted of 28 specimens of red soldier bug larvae.

Collection of materials included the following steps: collection of larvae by hand and their fixing in 70% ethanol solution; sorting and drying insects; registration of individuals in the diary and their description.

When registering a population sample each larva was given its own serial number. The description of specimens was performed by the method of E.P. Klymets [3] namely: examined the melanized picture on the insects' body; conducted the selection of forms that differed by one or more elements; painted these forms on the cards; systematized and made a phenotypic line of variability; revealed discrete variations (of phenes).

To study the intrapopulation diversity of groups of red soldier bugs 4 main signs are usually used: polymorphism of the picture of the pronotum "P"; polymorphism of elytra buds "A"

Table 1

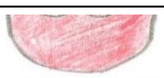
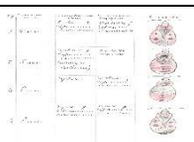
Variants of melanized picture of the red soldier bug larvae pronotum

Variants	Picure	Number	Description of the variant
P1		18	The upper and lower melanized bands are closely adjacent to each other.
P2		2	There are no melanized bands on the pronotum.
P3		5	The upper and lower melanized bands are closely adjacent to each other and are oval in shape.
P4		3	The upper and lower melanized bands are closely adjacent to each other but they are divided into two rectangular elements.

Next sign "A" in the catalogue relates to the figure of elytra of signs "B" and "C" - the picture on the insect abdomen (Table 2).

Table 2

Catalogue of variants of the melanized picture elements on the red soldier bug larvae

Variant	Number	Picture	Description of the variant
Wing shape			
A1	19		Rounded buds of wings without membrane.
A2	3		Rectangular buds of wings completely separated.
A3	2		Deformed round buds of wings.
A4	2		Buds of wings are rounded and the membrane goes along the full length
A5	1		Buds of wings are rectangular with the membrane along the full length
A6	1		Buds of wings are rounded and completely separated.
Number of spots on the abdomen			
B1	3		No spots on the abdomen.
B2	2		The abdomen has two round spots of the same shape.
B3	13		The abdomen has three round spots of the same shape.
B4	3		The abdomen has three oval spots.
B5	6		The abdomen has four round spots.
B6	1		The abdomen has four oval spots increasing in size gradually.
Striae on the body			
C1	25		No striae on the body.
C2	3		The abdomen is striated with approximately even lines.

and the figure (the number, shape of spots and striae) on the dorsal side of the red soldier bug abdomen "B", "C" [1].

It should be noted that in the phenetical analysis of the bilateral signs presented on the left and right side of the body (for red soldier bug it is the element "A"), we followed the rule: one sign – two phenes.

During the processing of the collected material we made up a catalogue of signs for regional fauna of red soldier bug larvae (Table 1, 2). Mathematical processing of the material that characterizes the phenetical population structure was performed by the Zhyvotovskyi L.A. technique [2]. The paper analyzed the incidence of the phene (P_m), studied the intrapopulation diversity of the phenes (μ) for each sign. To determine the reliability of the obtained findings, we calculated the error of the phenotype diversity (Sμ). We also found the ratio of scanty phenes for each sign (h).

Results and discussion. The results of phenetical analysis of red soldier bug urbanized populations in the urbanized ecosystem of Ternopil showed the presence of four elements of melanized picture on the integument of insect larvae. The largest number of phenes (6) was found in the "A" elements (shape of wings) and "B" (the number of spots on the abdomen). Somewhat fewer morphs were observed for sign"P" (picture of the pronotum) - 4 phenes, and the smallest number of species (2 phenes) is characteristic for sign "C" (Table 3).

Table 3

Phenetical analysis of the red soldier bug population by some signs

Sign	N	m	$\mu \pm S_\mu$	$h \pm S_h$
P	28	4	3,312 ± 0,285	0,142 ± 0,071
A	56	6	2,217 ± 0,387	0,63 ± 0,063
B	28	6	4,999 ± 0,423	0,139 ± 0,063
C	28	2	1,623 ± 0,148	0,153 ± 0,071

The highest values of intrapopulation phenetical diversity is characteristic for signs "B" (μ = 4,999) and "P" (μ = 3,312), the element "A" is the second with the value of the intrapopulation diversity (μ = 2,217), while the element "C" is characterized by the lowest value of this sign (μ = 1,623). The differences are reliable, as the reliability index (t) ranges from 2,3 to 4,62, 0,1 <p <0,02).

Correlation of the distribution of the scanty phenes ratio with the sign of intrapopulation diversity was not found. At the same time the incidence of rare forms among the studied signs tends to decrease (0,1 <p <0,01): «A» (h = 0,63), «C» (h = 0,188), «P » (h = 0,172),« B »(h = 0,167).

Conclusions. The results, which were obtained, allow to suggest that the high rate of intrapopulation diversity (μ) and the presence of rare larvae phenes (h) in the population of red soldier bug may be the result of unfavorable ecological state of urban ecosystem in the region, accompanied by a change in the typical environmental parameters associated with increasing anthropogenic or any other effect on insects.

The identified abnormalities in the structure of certain morphological structures of the body is an important indicator of disorders in population homeostasis [4]. Since these changes also characterize the level of stability of individual development of an organism, it is interesting to repeat such studies on the example of adult red soldier bugs, try to specify the list of factors that derange the state of regional ecosystem and to propose means of overcoming their influence.

References:

1. Экологический мониторинг. Методы биологического и физико – химического мониторинга. Ч.3.: учебное пособие / [под ред. проф. Д.Б. Гелашвили]. – Н. Новгород : НГПУ, 2006. – 371 с.

2. Животовский Л.А. Показатель сходства популяций внутрипопуляционного разнообразия / Л.А. Животовский // Журнал общей биологии. – 1980. – Т. 41. – № 6. – С.25 - 29.

3. Климец Е.П. Дискретные вариации рисунка на дорсальной стороне тела колорадского жука (Leptinotarsa decemlineata) / Е.П. Климец // Популяционная фенетика. – М.: Наука , 1997. – С. 45-58.

4. Електронний ресурс. Экологический анализ флуктуирующей асимметрии в изменчивости элементов меланизированного рисунка покрова клопа-солдатика (Pyrrhocoris apterus L.) в различных екосистемах. [Електронний ресурс] Режим доступу: http://earthpapers.net/ekologicheskiy-analiz-fluktuiruyuschey-asimmetrii-v-izmenchivosti-elementov-melanizirovannogo-risunka-pokrova-klopa-solda