

DEFINING THE THRESHOLD OF PUBLIC TOLERANCE TO BLACKFLIES IN THE REGION OF NOVI SAD

SONJA GRABOVAC, ALEKSANDRA IGNJATOVIĆ-ĆUPINA,
MARIJA ŽGOMBA, AND DUŠAN PETRIĆ

Faculty of Agriculture, University of Novi Sad, Serbia

ABSTRACT – Public perception was examined through a questionnaire distributed to inhabitants of settlements close to the Danube River. As an indicator of the relation between numbers of blackflies collected in the trap and perception of annoyance by the public, Spearman's coefficient of rank correlation was used. This analysis determined that the critical number and (threshold of public tolerance of blackfly presence) was 16 simuliids in the trap during the night. The participants were also divided into three groups: fishermen, gardeners, and third group composed of person spendings most of their time indoors. The results showed that the relation between individual perception and the number of simuliids in the trap was strongest in the fishermen.

KEYWORDS: Blackflies, human bait, dry ice baited traps, threshold level

INTRODUCTION

Simuliids – also called hump flies, buffalo gnats, blackflies, and turkey flies – belong to the suborder Nematocera (Culicoidea, Simuliidae), and today there are over a thousand identified species. Females are hematophagous and feed on humans and warm-blooded animals. They are molestants and vectors of the filarial worm *Onchocerca volvulus* (the cause of river blindness), but can also transmit many viruses and protozoans. The bite of a blackfly is very painful and often causes allergic reactions. Successive bites may cause the syndrome known as «blackfly fever», which is characterized by headaches, lymphadenitis, and depression.

It has been speculated that simuliids can transmit avian trypanosomas (BENNETT, 1958), and some scientists point out that certain species probably transmit myxomatosis of rabbits in Australia (MYKYTOWYCZ, cited from SMITH, 1973). There are numerous indications and examples of simuliid role in disease transmission. Because of their significance in the epidemiology of severe infec-

tions in human and veterinary medicine, very detailed assays have been conducted all over the world in order to find the most efficient way to control these pests.

The interest in and need for simuliid investigations in the region of Novi Sad derives from numerous complaints of inhabitants of settlements near the Danube River and streams in the Fruška Gora hills. In 2001, there was a reemergence of simuliids (first recorded in 1995) in the region of Novi Sad that attracted public attention and gave rise to a project financed by the Urban Affairs Department of the City of Novi Sad. Since then, research programs dealing with different aspects of blackfly biology, ecology and control have been carried out.

The aim of this part of the project was to define the threshold of public tolerance to annoyance by black flies. The critical number of flies established in this study will be used to assess the appropriate time for control measures.

MATERIAL AND METHODS

A survey was carried out in 2005 among the inhabitants of Šandrovac-Ledinci (a settlement near Novi Sad on the right bank of the Danube) from April to October. The pool consisted of 10 persons from five localities who gave their personal evaluation of blackfly presence. During five months, a total of 129 evaluations were made.

Individual perception of simuliid presence was categorized as follows: k1- no simuliids, k2- few, k3- bearable, k4- unbearable.

Blackflies were collected with a dry ice suction trap of the NS-2 type, which was placed near the settlements of the chosen persons (Fig. 1) The trap was active during the night before questioning, and readings were carried out once a week.



Fig 1. Dry ice-baited trap of the NS-2 type.

To determine whether there is a significant correlation between variables, the Kruskal-Wallis nonparametric test was applied, and Spearman's correlation coefficient was used as indicator of correlation. The confidence interval was 0.5 %, and the data were analyzed using SPSS 10 software.

RESULTS

Results of the Kruskal-Wallis test, which determines the significance of differences between median values, indicates that median numbers of blackflies are significantly different in comparisons k1-k3, k1-k4, k2-k3, and k2-k4, but not in comparisons k1-k2 and k3-k4 (Table 1) .

It seems that the questioned persons could clearly differentiate between no or few flies and bearable or unbearable annoyance levels. But they were not able to differentiate between bearable and unbearable or between no flies and few flies.

Table 1. Kruskal-Wallis test of correlation between numbers of trapped blackflies and individual estimation of annoyance level.

Category of annoyance				
	k1	k2	k3	k4
k1		0.072293	0.000000	0.000009
k2	0.072293		0.000018	0.000819
k3	0.000000	0.000018		1.000000
k4	0.000009	0.000819	1.000000	

Regression analysis of the answers to all inquiries and the number of simuliids collected in an NS-2 trap during the night showed that the relation between these two variables was highly significant ($r=0.608^{**}$, $p=0.000$). The coefficient of determination ($r=0.367$) indicates that the answers of participants in this pool were 36.7% dependent on the number of simuliids collected in the trap during the night (Fig. 2).

The participants in this survey were then divided into three groups: fishermen, who spent a significant part of the day by the river; gardeners, who spent a significant part of the day in the open, but in the vicinity of their houses; and persons who spent most of their time indoors. Analyses showed that there is a difference in the veracity of their evaluations.

The correlation of variables "personal evaluation" and "number of flies" in the fisherman group was very firm. Spearman's coefficient (0.735^{**}) is highly significant ($p=0.000$). The coefficient of determination ($r=0,591$) also shows that personal perception is influenced by the number of simuliids in the trap to an extent of 59.1 %. (Fig. 3).

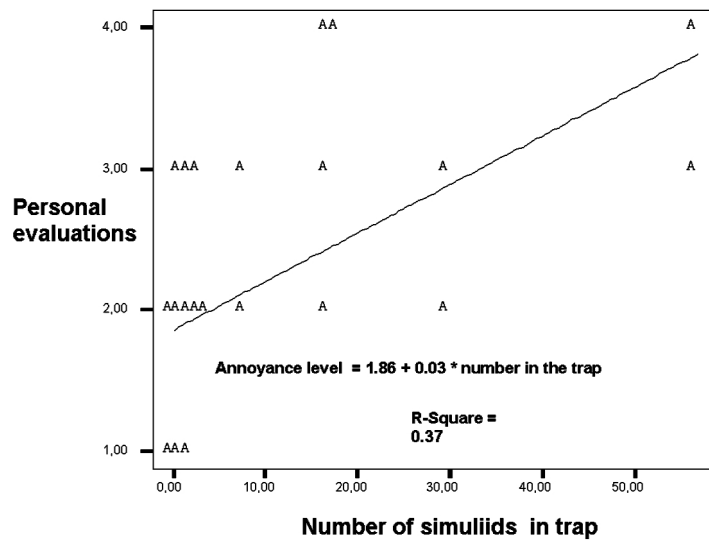


Fig 2. Correlation between individual estimations of the simuliid abundance and number of flies caught in the trap during the night before questioning (all evaluations).

Persons who spent their time in gardens distant from the main course of the Danube were less molested by simuliids and under weaker influence of these flies. Although the linear relation is firm ($r=0.596^{**}$, $p=0.000$), the coefficient of determination is lower than in the total count. It indicates that the individual evaluations were 38.2% influenced by the number of blackflies in the trap (Fig. 4).

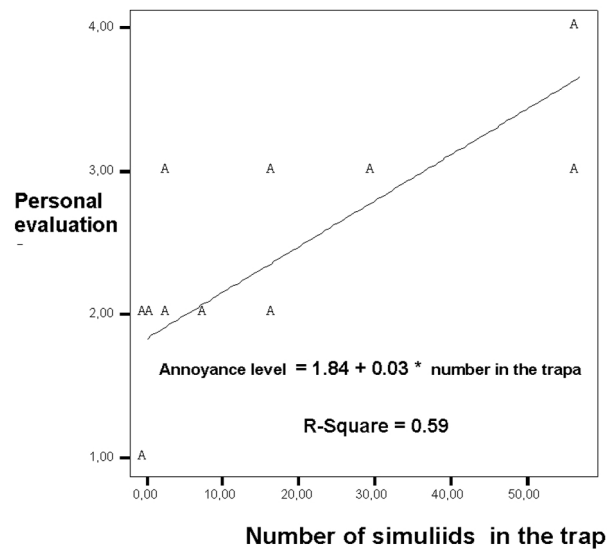


Fig. 3. Correlation between individual estimations of simuliid abundance and number of flies caught in the trap during the night before questioning (fishermen).

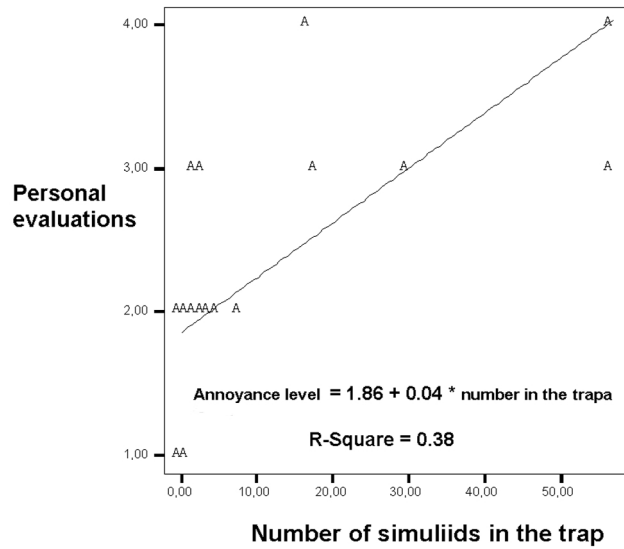


Fig 4. Correlation between individual estimations of simuliid abundance and number of flies caught in the trap during the night before questioning (gardeners).

The coefficient of determination for persons who spent their time indoors is $r=0.203$. This indicates that the number of simuliids caught in the NS-2 trap had the least influence on personal perception. However, it must be noted that the real number of blackflies indoors is the lowest, since they rarely enter houses or bite indoors.

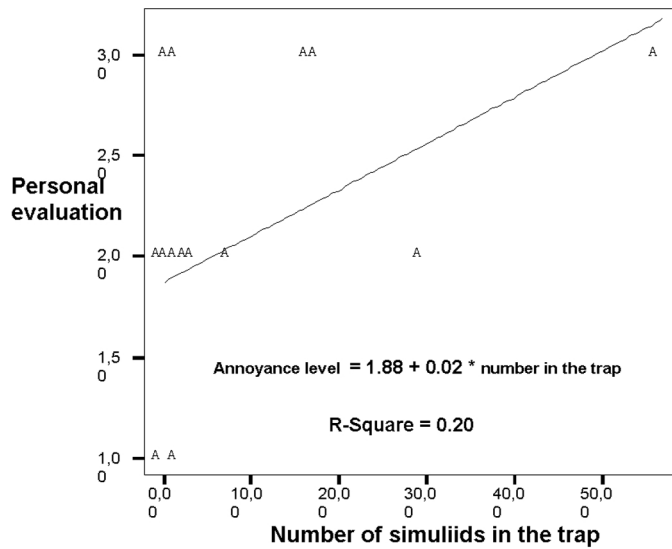


Fig 5. Correlation between individual estimations of the simuliid abundance and number of flies caught in the trap during the night before questioning (indoors group).

But, even in this case, the correlation is highly significant $r=0.479^{**}$ ($p=0.000$) (Fig. 5).

Although the analysis showed that the personal evaluations of all groups were strongly correlated with the number of simuliids in the trap during the night, it must be considered that blackflies are “daytime biters”, whose activity during the night is reduced. Comparison of annoyance estimation with samples taken in daylight might have given even more reliable results.

This analysis affords the possibility of determining the critical number of blackflies and the threshold of public tolerance of simuliids. Based on regression analysis, the following model was created:

$$\text{Level of annoyance} = 1.87 + 0.03 \times \text{number of simuliids in the trap}$$

Higher abundance causes greater annoyance of the public. This is shown on the box-plot diagram of the number of flies in the trap.

It can be concluded that the threshold of public annoyance is 16 simuliids in the trap during the night. This is the number of simuliids defined by at least 50% of participants in the survey as a bearable level of tolerance. For higher abundance, the situation was evaluated as unbearable. Sixteen is therefore the critical number above which control measures should be applied (Fig. 6).

The public’s perception of simuliid annoyance was investigated by SIMMONS ET AL., (2004). Their aims were to evaluate the relative level of annoyance based on the number of blackflies in

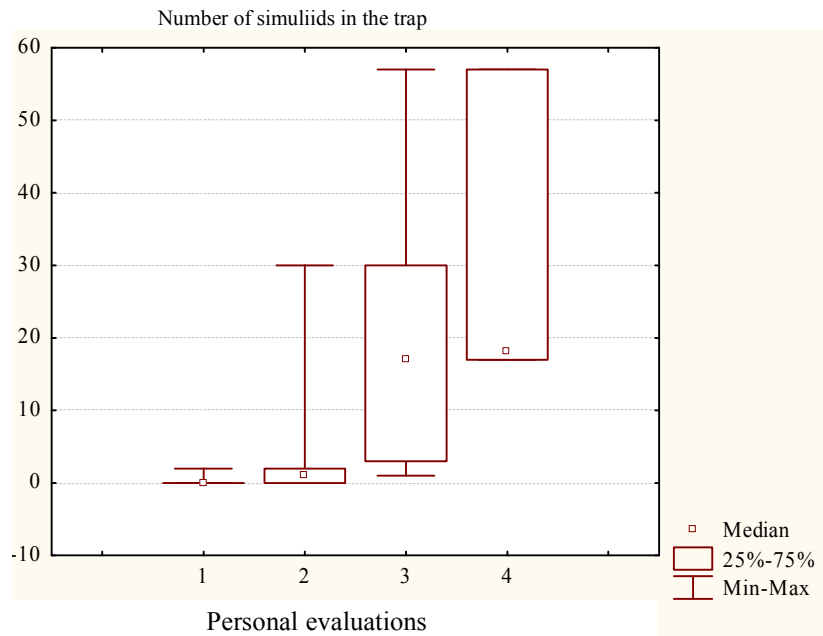


Fig 6. Confidence levels within the different estimation categories.

traps, to determine the level of tolerance, and identify locations where control measures are most needed.

Their observations were carried out during the period of greatest activity of blackflies (when the number of mosquitoes, on the other hand, was very small), since people mistake these two groups of insects. The obtained results indicated that there is a very low correlation between the number of simuliids in traps and the personal evaluations of participants in that survey. These results differ from those obtained in our work.

ZORANOVIĆ (2002) investigated the same correlations, but for mosquitoes, and estimated the level of tolerance for mosquito presence in 2001. There were four categories of individual perception of mosquito presence. The results of his survey showed that the pool members could not differentiate between “no mosquitoes“ and “bearable“, but could feel the difference between “no mosquitoes“ and “bearable“ on the one hand, and “many mosquitoes“ and “unbearable“ on the other.

ACKNOWLEDGEMENTS

We would like to thank the Urban Affairs Department, City of Novi Sad, and the Ministry of Science and Environment Protection, Republic of Serbia (Grant No. TR-6920B) for supporting this project; and Dr. Emilija Djorić for her cordial assistance in interpreting the results of nonparametric tests.

REFERENCES

- BENNETT, F.G. & A.M., FALLIS. 1958. Transmission of *Leucocytozon bonasae* Clarke to roofed grouse (*Bonasa umbellus* L.) by the blackflies *Simulium latipes* Mg. and *S. aureum* Fries, Canadian Journal of Zoology, 36: 533–539.
- SIMMONS, K., READ, N., & J., WALZ. 2004., Public Perception Of Annoyance From Blackflies (Biting Gnats), Blackfly Survey Results, 19.
- SMITH, K.G.V. 1973. Insects and Other Arthropods of Medical Importance, London, 561 pp.
- ZORANOVIĆ, G. 2002. Ocena uspešnosti suzbijanja komaraca roda *Culex* (Diptera: Culicoidea) na osnovu praćenja brojnosti odraslih jedinki, Diplomski rad, Novi Sad, Poljoprivredni fakultet, 36 pp.