IN VITRO ИЗПИТВАНЕ ЗА ИНСЕКТИЦИДНА АКТИВНОСТ НА НАТУРАЛНИ ПЕСТИЦИДИ НА БАЗА РАСТИТЕЛНИ САПУНИ СПРЯМО *APHIS NERII* BOYER DE FONSCOLOMBE И *MACROSIPHUM ROSAE* (L.) (HEMIPTERA: APHIDIDAE)

IN VITRO SCREENING FOR INSECTICIDAL ACTIVITY OF NATURAL PESTICIDES BASED ON PLANT SOAPS AGAINST *APHIS NERII* BOYER DE FONSCOLOMBE AND *MACROSIPHUM ROSAE* (L.) (HEMIPTERA: APHIDIDAE)

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Abstract

The insecticidal activity of four natural products based on soaps prepared from plant oils (sunflower and olive) against *Aphis nerii* Boyer de Fonscolombe and *Macrosiphum rosae* (L.) was evaluated *in vitro*. It was found that SLGEL1521OLT, SLUN and OLGEL manifested the strongest insecticidal activity against both aphids.

A higher efficacy was observed towards *M. rosae*, as compared with *A. nerii*. The number of surviving individuals was recorded after 24h.

The efficacy was estimated by means of the *Henderson and Tilton* formula (1955) and the results were statistically analyzed with the R language for statistical computing (R Development Core Team, 2011) and the drc R language package.

Key words: soaps, natural pesticides, *Aphis nerii, Macrosiphum rosae.*

INTRODUCTION

The oleander aphid, *Aphis nerii* Boyer de Fonscolombe, sometimes called the milkweed aphid, is a common pest of several important ornamental plants in the families of *Apocynaceae* and *Asclepiadaceae.*

This species probably originated in the Mediterranean region, the origin of its principal host plant, oleander *Nerium oleander* L. (Blackman and Eastop, 2000). This aphid is widely distributed in tropical and subtropical regions including many Pacific islands (Blackman and Eastop, 2006), and in glasshouses in colder climates (Takada and Miyazaki, 1993).

The first record of *A. nerii* in Iraq were given by Bodenheimer and Swirski (1957) on *N. oleander* and on citrus sp. This aphid is commonly found in Florida feeding on oleander, *N. oleander*, milkweeds, such as butterfly weed, *Asclepias tuberosa*, and scarlet milkweed, *Asclepias curassavica*, and wax plant, *Hoya carnosa*. In Bulgaria the species was found in greenhouses feeding on *N. oleander* (Yovkova et al., 2013).

The rose aphid *Macrosiphum rosae* (L.) originated from Europe. It is now a globally distributed species, whose presence is described almost worldwide, except for eastern Asia (Blackman and Eastop, 2000). The aphid feeds mostly on rosaceous plants, but it is known to feed on plant species in other families.

Despite its presence on different host plants, the economic impact of *M. rosae* is primarily due to feeding damage on cultivated roses (Wöhrmann et al., 1991; Shaheen et al., 2007). In Bulgaria the species is the most common insect pest of roses (*Rosa* sp.*)* – ornamental, essential and wild, in greenhouses and in open field (Grigorov, 1980; Yovkova et al., 2013).

The oleander and the rose aphid damage plants by sucking sap from plant tissues and also excrete large amounts of honeydew, encouraging the growth of sooty moulds, which form a black covering over affected leaves and blossoms.

The symptoms of damage are distortion of new leaves and flowers. In addition, the growing terminals can be deformed. Severe aphid infestations can result in defoliation of the plant and loss of the flower crop. Aphids breed very rapidly and build up vast numbers, especially in warm, humid weather (Boundy et al., 1980).

Insecticidal soaps and oils are often effective against soft-bodied insects such as aphids. They are promising alternatives for use in insect management.

The aim of the current study is to evaluate the insecticidal activity of four natural products on base of soaps prepared from plant oils (sunflower and olive) against *Aphis nerii* Boyer de Fonscolombe and *Macrosiphum rosae* (L.).

MATERIALS AND METHODS

The experiments were carried out in 2015 in the laboratory of Phytopharmacy and Ecotoxicology, of the Agricultural University of Plovdiv. The insecticidal activity of four natural products on base of soaps prepared from plant oils (sunflower and olive) against *Aphis nerii* Boyer de Fonscolombe and *Macrosiphum rosae* (L.) was *in vitro* evaluated.

The following products were tested: SLGEL1521OLT with 20% concentration of active substance - potassium salts of fatty acids; SLUN with 20% concentration of active substance - potassium salts of fatty acids; OLGEL with 20% concentration of active substance - potassium salts of fatty acids.

Natural colonies of nymphs and wingless adults of oleander aphid, *A. nerii* feeding on leaves of butterfly weed *Asclepias tuberosa* and rose aphid *M. rosae* feeding on shoots of *Rosa hybrida* were used. The individuals were placed on the layer of filter paper soaked with tested insecticide in 10 cm high plastic caps (5 cm diameter of the bottom).

Each variant was implemented with three replicates with 10 aphids in each repetition. The variants were treated with tested concentrations of products and the control was treated with water. As standard variant was used Karate Zeon® on the base of lambda-cyhalothrin produced by Syngenta.

The number of surviving individuals was recorded on the 24 hours after the treatment. The efficacy was estimated according to Henderson and Tilton formula (1955). Ten different concentrations were tested to be determined LC_{05} (NOEL), LC_{25} (LOAEL) LC_{50} and LC_{90}. The received data from conducted tests were statistically manipulated with R language for statistical computing (R Development Core Team, 2011) and drc R language package (Ritz and Streibig, 2005).

RESULTS AND DISCUSSION

The figure below show the Dose - Response Modeling for SLGEL1521OLT product.

The received toxicological data are:

- NOEL (LC_{05}) = 7,76 % (m/vol)
- LOAEL (LC_{25}) = 10.32 % (m/vol)
- LC_{50} = 12.23 % (m/vol)
- LC_{90} = 17.17 (m/vol)
- AIC of the model = 26.76

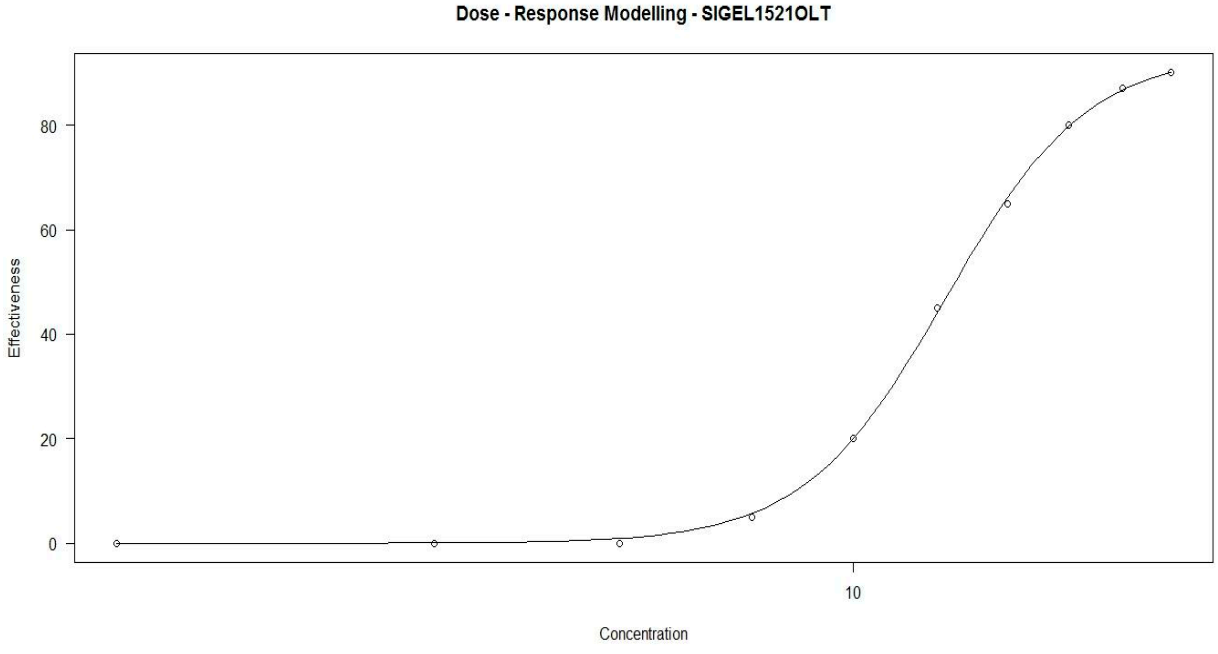

Fig. 1. *Dose - Response Modeling for SLGEL1521OLT product*

The next figure (fig. 2) is about the effectiveness of the SLUN product:

The received toxicological data are:
- NOEL (LC_{05}) = 9.33 % (m/vol)
- LOAEL (LC_{25}) = 10.74 % (m/vol)
- LC_{50} = 12.15 % (m/vol)
- LC_{90} = 19.93 (m/vol)
- AIC of the model = 37.97

The last figure (fig. 3) describe the Dose - response Modeling of the OLGEL:

The received toxicological data are:
- NOEL (LC_{05}) = 12.93 % (m/vol)
- LOAEL (LC_{25}) = 14.76 % (m/vol)
- LC_{50} = 15.96 % (m/vol)
- LC_{90} = 18.67 (m/vol)
- AIC of the model = 8.78

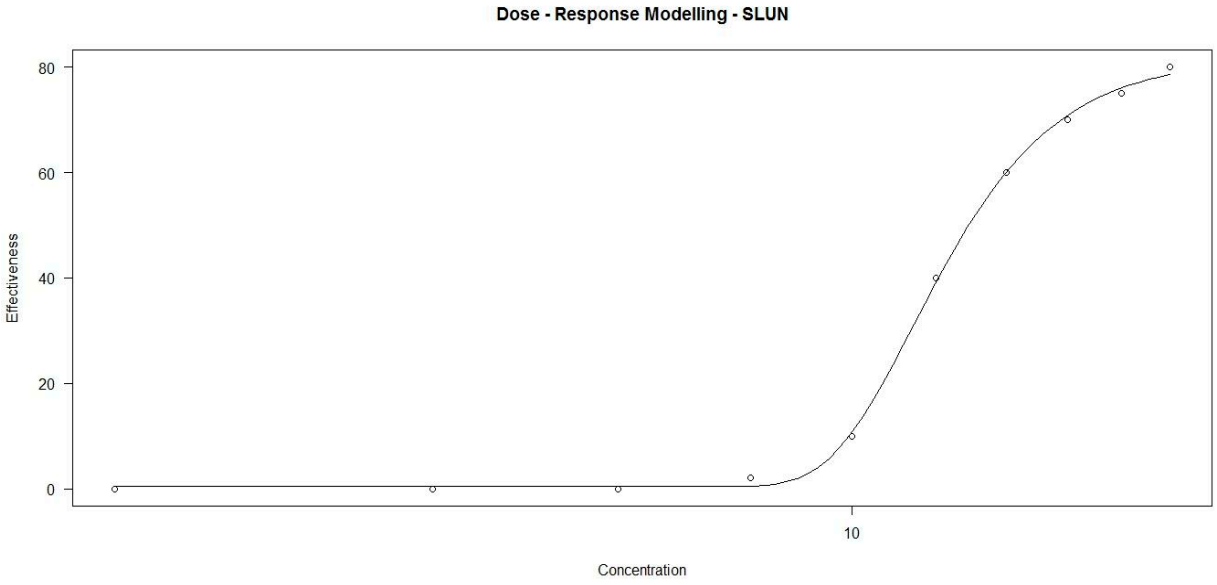

Fig. 2. *Dose - Response Modeling for SLUN product*

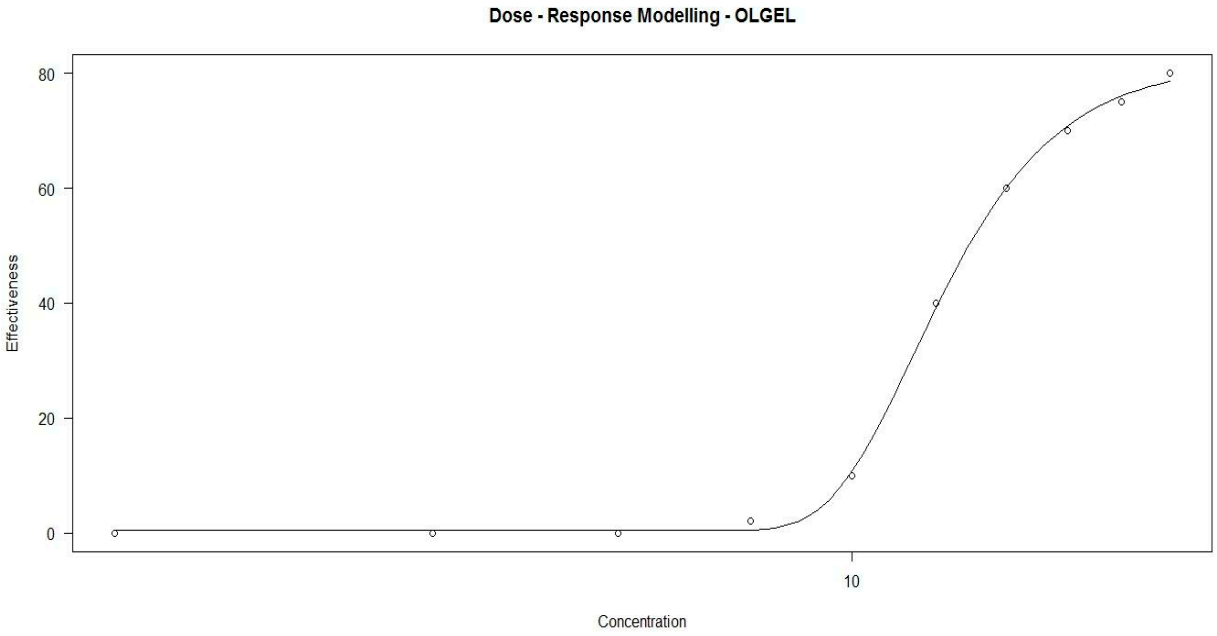

Fig. 3. *Dose - Response Modeling for OLGEL product*

CONCLUSIONS

1. The results showed that all of the tested products manifest insecticidal activity against *Aphis nerii* however in the high concentrations - LD_{90} between 17.17 and 19.93 % (m/vol). Conducted Dose - Response Modeling reveal the very close values of the major toxicological index due to the fact that all products are potassium salts of the fatty acids with 20 % concentration according to the active substance.

2. The effect of the relatively high effectiveness concentrations is minimized by the fact that the production cost of the tested products can be very low due to the cheap recourses from which they are prepared and simple manufacture process. The AIC of the models were between 8.78 and 37.97 which prove the good fitness of the models and reliability of the reveived values.

REFERENCES

Blackman, R. L. and V. F. Eastop, 2006. Aphids on the World's Herbaceous Plants and Shrubs. Chichester: John Wiley and Sons, Ltd.

Blackman, R. L. and V. F. Eastop, 2000. Aphids on the world's crops. 2nd edu. Johnwiley, Chichester UK, 466 p.

Bodenheimer, F. and E. Swirski, 1957. Aphidoidea of the Middle East. Weizmann Science Press, Jerusalem, 378 p.

Boundy, K., J. Egan, S. Krieger, T. Pinzone, S. Hook, D. Eilert, 1980. Royal Botanic Gardens and Domain Trust Act. Online at https://www.rbgsyd.nsw.gov.au/plant_info/ pests_diseases/fact_sheets/rose_aphids

Grigorov, S., 1980. Leaf aphids and their control. Zemizdat. Sofia, 285 p.

Henderson, C. F. and E. W. Tilton, 1955. Tests with acaricides against the brow wheat mite, J. Econ. Entomol. 48: pp. 157–161.

R Development Core Team, 2011. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/

Ritz, C., and J. C. Streibig, 2005. Bioassay Analysis using R. J. Statist. Software, 12.

Shaheen, G., G. M. Zaz, 2007. Biology of rose aphid *Macrosiphum rosae* L. (Homoptera: Aphididae) in Kashmir. Applied Biological Research 9: 50–53.

Takada, H. and M. Miyazaki, 1993. Bisexual reproduction of a form of Aphis nerii from Hokkaido. Appl. Ent. Zool. 28: pp. 199–205.

Wöhrmann, K., D. F. Hales, J. Tomiuk, E. M. Schmiedt, G. Rettenmeier, 1991. Induction of sexual forms in the rose aphid *Macrosiphum rosae*. Entomologia Experimentalis et Applicata, 61: pp. 17–24.

Yovkova, M., O. Petrovic-Obradovic, E. Tasheva-Terzieva, A. Pencheva, 2013. Aphids (Hemiptera, Aphididae) on ornamental plants in greenhouses in Bulgaria. ZooKeys 319: pp. 347–361.