

AFPP – 6^e CONFÉRENCE SUR LES MOYENS ALTERNATIFS DE PROTECTION
POUR UNE PRODUCTION INTEGRÉE
LILLE – 21, 22 ET 23 MARS 2017

**EFFICIENCY OF PLANT *AGERATUM HOUSTONIANUM*
(PLANTAE: ASTERIDS) AGAINST THE GREENHOUSE WHITEFLY AND APHIDS**

A. S. HAKOBYAN, K.P. DILBARYAN, L. H. GHAZARYAN, I.S. STEPANYAN.

*Institute of zoology of Scientific Center of Zoology and Hydroecology NAS RA,
P.Sevak, 7, 0014, Yerevan, Armenia. E-mail: lusine.ghazaryan24@gmail.com*

ABSTRACT

Insecticidal properties of *Ageratum houstonianum* on activities and survival of greenhouse whitefly and aphid (*Aphis fabae*) (Homoptera: Aphididae) were studied in greenhouse and laboratory conditions. It was revealed that the *A.houstonianum* have toxicity for greenhouse whitefly and aphid. Term of 100% lethal effects of *A.houstonianum* lasts 9 days for aphids. Extracts from *A. houstonianum* can be recommended for future implementation in activities for biological control against greenhouse whitefly and *Aphis fabae*.

Keywords: bean aphid, greenhouse whitefly, *Ageratum houstonianum*, botanical insecticides, biological control.

INTRODUCTION

Whitefly, (*Trialeurodes vaporariorum*) is one of the most common and dangerous plant pests infesting vegetable, fruit and decorative greenhouse plants in Armenia. In recent years intensive growth of this species was observed not only in the closed, but also in open ground areas, specifically in a close proximity with greenhouses.

Whitefly is a typical polyphagous insect. In favorable condition whitefly gives up to 12 generations of offspring per year. Since most of the insecticides affect only adults and larval stages capable of movement of this species, pest control measures can be successful only with multiple chemical treatments repeated at 2-4 day intervals (Herman, 1995). These chemical measures are costly (approximately 75% of plant protection expenses), have low efficiency and can contaminate both plants and surrounding environment).

Although the main measures against these pests are chemical pesticides, multiple investigations reported a successful biological whitefly control using entomo-parasites, such as *Trichogramma* West., or entomopathogenic fungi (Belyakova *et al.*, 2005). Yet these biological measures are efficient only if combined with other means of pest control (Chkalov, 1986).

Bean aphid (*Aphis fabae*) is another common polyphagous plant pest of many vegetables (*Fabaceae*, *Solanaceae*, *Apiaceae*), wild and decorative flowering plants (*Papaveraceae*, *Asteraceae*, *Malvaceae*, etc.) etc. in closed and open grounds in Armenia.

In recent years an increase in chemical insecticide use, including phosphor-organic compounds, has been recorded in Armenia. These chemical pesticides are efficient against pests only during the first use, but induce resistance over time. Additionally the increased use of chemical pesticides causes environmental degradation, evolution of resistant pest species, contamination of food products by pesticides, increased costs of agricultural practices and negative effects on leaving organisms, including human, around the pesticide contaminated area. Therefore, there is an urge to develop safe and environmentally friendly biological pest control.

Decorative plant *Ageratum houstonianum* Mill. is widely used in decorative gardening and parks in Armenia. Several alkaloids of pyrrolizidine characters have been detected in the leaves of this species (Wiedenfeld, Andrade-Cetto, 2001). Even these alkaloids are known to be very carcinogenic for mammals causing first liver lesions at very low doses, they also can be interesting tools for biocontrol as they suppress the production of juvenile hormone of insects and induce early transformation of immature larval stages into anomalous adult form- sterile imago (Acamovic *et al.*, 2004)

As a matter of above mentioned, the insecticidal properties of *A.houstonianum* were interesting to study. The goal of our work was an investigation of insecticidal effects of *A.houstonianum* on greenhouse whitefly (*Trialeurodes vaporariorum*) and bean aphid (*Aphis fabae*).

MATERIALS AND METHODS

Experiments took place during 2011-2016 in two greenhouses of Zoology and Hydroecology Scientific Center of the Academy of Sciences, RA. Laboratory cultures of *Trialeurodes vaporariorum* and *Aphis fabae* were handled in the laboratories of Zoology and Hydroecology Scientific Center of the Academy of Sciences, RA. In our greenhouse of 200 m² size year-long different plants are grown for experiments. The plants in the greenhouse (*Zinnia* L., *Geranium* L., *Hibiscus rosa-sinensis* L.) suffered whitefly infestation during several years. Chemical insecticides, such as: Abamectin 0.15 EC (QUALY-PRO), TALSTAR 250 EC, Agrares Insec Stop 1 and 2 (AGRARES Ibera SL) were used against the pests.

For greenhouse whitefly capture, 30 x 30 cm yellow glue traps were used. The traps were made of cardboard and covered by entomological glue Pestfix. The pest damage was evaluated by methods described by Beglyarov (Beglyarov, 1985) and Rak (Rak, 2012). The population size of the greenhouse whitefly was estimated by counting insects on 30 randomly selected leaves using either magnifying glasses or binoculars. Biological efficiency was measured by the method described by Tverdukov (1993).

Isolated plots from one isolated leave of *A.houstonianum* were made in Petri dish. One isolated leave of *A.houstonianum* was placed onto cotton plot in Petri dish for the experiments with aphid. The plots were placed on the wet cotton in Petri dishes. As a control group identical plots from *Hibiscus rosa-sinensis* plants were made. Aphids were placed on these plots using brushes. Experiments were done in triplicates with min of 20 mature wingless female aphids in each set. The plots were handled at 20°C and relative humidity of 60%. The aphids were counted every other day starting from Day 1. Biological efficiency C (%) was estimated according the following equation for third, fifth, seventh and ninth days:

$$C = \frac{100(a-b)}{a},$$

Where “a” is the starting amount of individuals and “b” is the amount of individuals after the experimental treatment.

RESULTS AND DISCUSSION

Experience with the whiteflies

The influence of chemical insecticides, such as Abamectin 0.15 EC (QUALY-PRO), TALSTAR 250 EC, Agrares Insec Stop 1 and 2 (AGRARES Ibera SL) at recommended concentrations, on whitefly was investigated during the first two years of experiment (2011-2012). The effect of yellow traps was investigated during the next two year (2013-2014).

In spite of chemical treatments by insecticides, there was an outbreak of whitefly population in the spring of 2014. Even muntrie treatments at 3-4 day intervals did not succeed to control pest numbers. In the beginning of May, traps were vertically placed above the plants at 10-15 cm distance: in average 1 tap per 10 m² was hung in an experimental field of 200 m². Our data indicated that the simple control by traps is very efficient: daily hundreds and thousands of whiteflies can be captured, resulting in a decrease of insect densities up to the minimal level of 5-10 individuals per leaf (Dilbaryan, Akobyan, 2014). During the spring 2016, 2m² of our first greenhouse area was planted by *A.houstonianum*. Flowerpots with whitefly infected *Hibiscus rosa-sinensis* plants were placed in the 75 m² area of the greenhouse. The initial infestation level was 5-10 individuals per leaf. After a few days of *Ageratum* growth, whiteflies were detected also on *Ageratum* leaves. The whiteflies started feeding and laying eggs on *Ageratum* plant. Approximately 25% of the offspring (nymph) on *Ageratum* leaves was not viable. When a part of the *Hibiscus rosa-sinensis* flowerpots were subsequently moved back to second greenhouse with no *A.houstonianum* plants, the level of infestation increased (200-600 individuals of whiteflies per leaf). *Hibiscus rosa-sinensis* plants in the greenhouse with *Ageratum* plants were relatively pest free: 2-5 individuals per leaf.

Since all the other plant species in the greenhouse were whitefly free, while main concentration of whitefly was on the *Ageratum* plant, we have concluded that *A.houstonianum* has attractant properties.

Experience with the aphids:

Aphids were placed on *Ageratum* plots. Initially the aphids tried to feed on the plant, but mortalities occurred during 3 - 9 days. Some of the aphids fell into a stupor and also died. 100% lethal effect was observed in 9 days (Table 1).

Table 1. Biological efficiency (C%) of *Ageratum* leaves during the experiment with aphids = % death in aphid population.

	Day 1	Day 3	Day 5	Day 7	Day 9
C (%)	0%	15%	36.6%	78.3%	100%

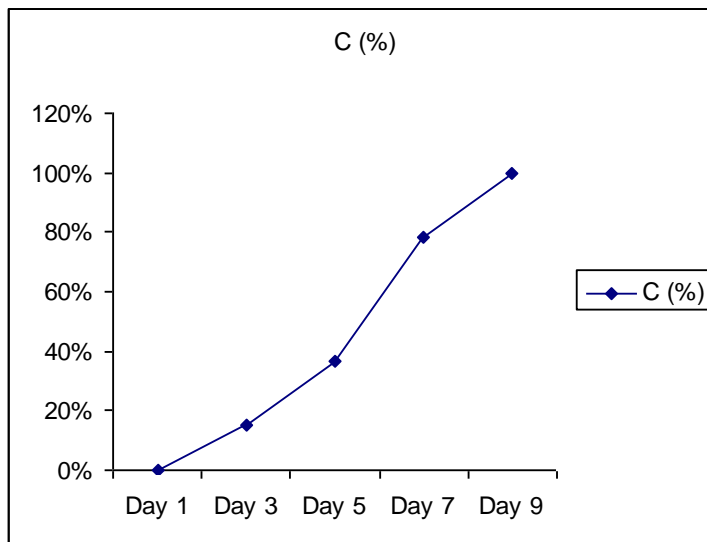


Figure 1. The graphic presentation of the biological efficiency (C%) of *Ageratum* leaves during the period of 9 days in the experiment with *Aphis fabae*.

CONCLUSIONS

Our data demonstrates that *A.houstonianum* has toxic effect on investigated species of whitefly and aphids. Treatment with this plant leaves decreased the infestation levels by whitefly Term of 100% lethal effects of *A.houstonianum* lasts 9 days for aphids. In addition to insecticide effect, the *A.houstonianum* demonstrated attractant properties. The toxicity of *A.houstonianum* on whitefly and aphids might be caused by specific non-favorable compounds in the plant tissues. To achieve high efficacy of whitefly capture *A.houstonianum* planted surface area should be at least 1% of greenhouse surface.

Our data can suggest evidence of efficacy of use of *A.houstonianum* as neighboring plants, but we can expect that extracts of *A.houstonianum* may have also a potential to be used for the development of new biological pesticides with a large spectrum of phloem feeder pests.

LITERATURE

- Akamovic T., Stewart C.S., Pennycott T.W. 2004. Poisonous Plants and Related Toxins. Wallingford, Oxfordshire, UK : CABI. 586 p.
- Belyakova N. A., Krasavina L.P., Saprigin A.A., Pazuk I.M., 2005. Development of natural recourses of predator polyphagous for use in biological protection. *Biological means of plant protection, the technologies of they production and application*. SpB, VIZR, p.55-63
- Budai C. S., Èz. Ès. Vedek 1975. Üveghazi molytetÜ (*Trialeurodec vaporariorum* Westwood) elleni NÖvÈnyvedelem., An XI. N 10, p. 462-464.
- Chkalov A. A., 1986. Biological protection of vegetables against pests in greenhouses. Moskow, Rossel'hosizdat. 95p. Dilbaryan K.P., Hakobyan A.S. Khachatryan A. G., 2014. Efficiency of adhesive traps in the fight against greenhouses whitefly (*Trialeurodec vaporariorum* West.) Proc. Of the international confer. Yerevan, 109-111.
- Gorbachev I. W., Hricenko V. V., Zakhvatkin Yu., L., Isaichev V.V. 2002. Protection of plants against pests. M., Kolos, 467p.
- Van Lenteren J.C., H. J. W. van Roermund , and S. Sutterlin. 1996. Biological control of greenhouse whitefly (*Trialeurodes vaporariorum*) with the parasitoid *Encarsia formosa*: how does it work? *Biological Control*, 6, 1-10.
- Rak N. S. 2000. Features of biological protection of plants in greenhouses of Polar region. Avtoref of diss. SpB., VIZR, 22p.
- Tverdukov A., P. 1993. The biological method of pest control and diseases in greenhouses. *Reference book*. Kolos, 30-36.
- Wiedenfeld H, Andrade-Cetto A. 2001. Pyrrolizidine alkaloids from *Ageratum houstonianum* Mill. *Phytochemistry*, 1269-1271.