Preliminary Research Concerning the Application of Vermicompost on Aphid Control in Cherry

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ABSTRACT

There is a growing interest for sustainable agriculture as a response to consumer's health interest. Vermicompost is a product that answers to this demand. Due to the complex chemical composition it can be used both as a fertilizer, and pesticide. The experiment was conducted in laboratory conditions. On infested branches with black cherries aphids, three different concentrations of liquid vermicompost were applied. The variants were separated by an insulator made from solid framework covered with gauze and each of them consisted in three replicates. The data was registered at 24h, 48h, and 72h when the number of dead individuals was rated and at seven days when both alive and dead individuals were counted. Regarding the effect of liquid vermicompost concentration, the highest mortality was obtained in variant 2 (1:5) with a percentage of 82.72%. Variant 3 follows with the most concentrated solution of vermicompost (1:3), but a lower percentage 73.84%. In variant 1 (1:10) the mortality was of 70.59%, this represents the lowest value registered.

Keywords: black cherry aphid, *Myzus cerasi* F, organic orchard, vermicompost.

INTRODUCTION

The fruits have a high nutritional value, given by their complex content in nutrient and energetic substances, as well as the favorable influence they have on the normal function of human body. Because there is a concern of the consumer to feed healthier, the producers are heading for organic productions. Vermicompost extract can be applied at the root or foliar, by direct application or with irrigation. Because it is not toxic and does not produce plants burns, it may be recommended to be used in organic agriculture (Gutierrez-Miceli *et al.*, 2008, Lazar *et al.*, 2014).

Vermicompost is a product that has in its composition C, H and O and also nutritive substances like NO₃, PO₄, Ca, K, Mg, S, with a positive effect on plant growth (Singh, 2008 cite by Theunissen *et al.*, 2010). Studies have shown satisfying results on the effect of vermicompost as

insecticide on *Tetranychus urticae*, *Pseudococcus* sp., *Myzus persicae* and *Meloidogyne incognita* (Arancon *et al.*, 2007a, Arancon *et al.*, 2007b, Arancon *et al.*, 2005).

After many years of research, it has been found that the extract of vermicompost produced by *Eisenia foetida* and its dilutions contain enzymes known as different types of chitin. Chitin is an organic substance that has a repellent effect on insects; it is found in their exoskeleton and also in the cell wall of fungi (Subha *et al.*, 2010). The chitin administered through vermicompost is absorbed into plant tissues and, after ingestion, has a destroying effect on exoskeleton of pests (Yasir *et al.*, 2009).

Myzus cerasi F. is a migratory species which uses as primary host the cherry tree or sour cherry and as secondary hosts, various species such as: *Galium* spp., *Veronica* spp, *Asperula* spp. and *Lepidium* spp. (Paşol *et al.*, 2007).

Black cherry aphid presents an economical importance (Ulusoy, 1999), the damage affects the top shoots and the underside of young leaves, which became twisted. After a strong attack the power of fructification and growth of trees can decrease (Roşca *et al.*, 2011). For an efficient control of this pest are recommended chemical systemic products such as acetamiprid and pirimicarb before forming colonies (Kutinkova and Radoslav, 2004).

The black cherries aphid may develop over a year, a number up to 12 generations. The appearance of first generation takes place at a cumulating of 43-60.9 active degrees above the lower threshold in development, considered 3 degrees Celsius (Rakauskas, 1984). In Romania, recent research on biological peculiarities have been carried out by Mincă (2011).

MATERIALS AND METHODS

The experiment was conducted in laboratory conditions, at the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca in July 2014 and as experimental material it were used cherry branches infected with aphids and vermicompost.

Experience consisted in three experimental variants, each with three repetitions. The difference between variants consisted in the concentration of vermicompost dilutions. In the variant number 1, it was applied a solution of 1:10 dilution (Var. 1). Concentration applied on the variant number 2 was 1:5 (Var. 2) and 1:3 for variant 3 (Var.3). The liquid extract obtained from vermicompost was achieved by immersing vermicompost in water. The solution was aerated for 48h with an air pump.

Repetitions consisted in an infested cherry tree branch, about 40 centimeters long that was inserted into a bottle glass of 330 ml, previously filled with water. Branches were collected several hours before assembling the experiment in an orchard infested by black cherry aphid, located near the city of Cluj-Napoca.

Each variant was isolated by an insulating, with stable frame, made of plastic and covered with a double layer of gauze. Repetitions of each variant were placed on white paper (Figure 1).

While collecting the necessary material, special attention was paid to variety and at the degree of infestation in order to eliminate differences between repetitions respectively between variants.

Checking the efficiency of vermicompost extract on aphid was performed at 24 h, 48 h, 72 h and 7 days after the setting of the experiment. Registration number of dead individuals in each variant was made by the following procedure: isolator removal followed by a slight shaking of branches (for removing dead individuals who remained on the branch), temporary moving of glass vessels on the white paper support, counting and removing fallen dead specimens and finally restore variant to its initial place.

Because the dimensions of black cherry aphid are reduced, at the end of 7 days of monitoring we counted live specimens, and then summing with dead individuals registered at each reading, we obtained the initial number of specimens existing in each repetition.

For interpretation of the data we calculated the percentage of mortality within each interval, but also final mortality for the three concentrations of the tested vermicompost liquid using Duncan test.

Fig. 1. A. Isolation for the biological material used to prevent insect escape;
B. Replicates for V3, placed on white paper in order to ease the aphids counting.

RESULTS AND DISCUSSION

Following the studies conducted we found that vermicompost can affect in some proportion the *Myzus cerasi* F. population. The effectiveness of the vermicompost is determined by using different concentrations as mentioned above.

Of the total dead specimens, at 24 hours after treatment the proportion ranged between $4.27 \pm 3.38\%$, in V2, and $6.35 \pm 4.78\%$ in V3 (Table 1). None of the variants showed differences insured statistically, meaning that at 24 hours the vermicompost concentrations are not influencing the aphid mortality. This is expected due to the particularity of the biopesticides: they are actioning slower than the traditional chemical treatment.

In the next interval of observation, this parameter presented large oscillations, ranging from $8.90 \pm 2.18\%$ in the first variant to $23.86 \pm 9.42\%$ in the second variant. At 48 hours, p value is 0.047, showing that V2 is statistically better than the other two variants.

At 72 hours from the beginning of the experiment, the best concentration was V2 with a value of $47.01 \pm 25.36\%$ followed by the other two. Although one can see the differences between the raw results, because of the wide dissimilarity of counting within the variants, the differences are not statistically insured.

The highest mortality rate of aphids was reported at 7 days from the start of monitoring, ranging between $70.59 \pm 21.88\%$ for V1 and $82.72 \pm 22.63\%$ for V2.

It can be said that this bioinsecticide does not present shock effect, it's action being slow, manifesting in time, as expected.

As indicated in figure 2, in first variant, where the concentration of vermicompost used was 10% (V1), from 511 total individuals only 167 were alive. The mortality in this item has been 70.59%, and represents the lowest value from the 3 concentrations tested.

At the vermicompost concentration of 20% (V2), out of the 505 specimens of *Myzus cerasi*

Tab. 1. Number of death individuals in each repetition and each variant.

Variant	Dead individuals 24h (%)	Dead individuals 48 h (%)	Dead individuals 72 h (%)	Dead individuals 7 days (%)	Alive at 7 days (%)
V.1 (1:10)	5.06 ± 2.28	8.90 ± 2.18 b	28.35 ± 26.59	70.59 ± 21.88	29.41 ± 21.88
V.2 (1:5)	4.27 ± 3.38	23.86 ± 9.42 a	47.01 ± 25.36	82.72 ± 22.63	17.20 ± 22.63
V.3 (1:3)	6.35 ± 4.78	10.33 ± 4.71 b	15.31 ± 5.95	73.84 ± 17.81	26.13 ± 17.81
<i>p</i>	0.785	0.047	0.269	0.769	0.769

Average value $\pm$ standard deviation (n=3). Different letters are significantly different for $P \leq 0.05$.

The difference between any two values, followed by at least one common letter, is insignificant.

Fig. 2. The results obtained at 7 days from the experiment start.

F, 418 individuals have died, with a registered value of mortality of 82.72%. This is the variant in which it was recorded the highest mortality rate. Compared to the previous variant there was an increasing rate of mortality with 12.13 %.

When applying bioinsecticide in dilution of 1:3 (V3), the percentage of mortality of aphids was 73.84%. In this variant from 432 of total specimens, remained alive 113, the rest of 319 being death.

The total number of individuals of *Myzus cerasi* F. subjected to the experiment, for experimental variants, oscillated between 432 specimens (in V3) and 511 specimens (in V1).

The data obtained in this experiment are similar with those published by Arancon et al. (2007b) in combating of nematodes, respectively with those published by Arancon et al. (2007a) for aphids control on vegetables.

This preliminary research brings new the possibility of using with good results the vermicompost as a biopesticide in sweet cherry orchards against *Myzus cerasi* F. Also, the study is a strong base in further research regarding the effect of the vermicompost as an insecticide.

CONCLUSIONS

Vermicompost extract dilutions caused a mortality of *Myzus cerasi* F. in an rate ranging between 70.59 % and 82.74%, this is depending on concentration utilized.

The highest percentage in mortality was obtained to the application of product in a concentration of 20% (V2), statistically confirmed at 48 hours from treatment.

In the first two days after the application of the treatment, the efficiency is low, the product has no shock effect, but it increases 7 days after, showing a mortality f up to 82.74%.

Following the studies conducted, we can conclude that (a) the extract of vermicompost may lead to lower population density of aphids, found in organic orchards but also in conventional ones, (b) to lower the standard deviation, more replicates should be use, (c) a control variant should be take into consideration in order to underline the effectiveness of the vericompost in the first days after application.

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