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INSECTICIDE ACTIVITY OF PLANT EXTRACTS AGAINST PESTS OF OILSEED RAPE

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Abstract

Oilseed rape attacked by many pests, some of them, such pollen beetle (Meligethes aeneus F.) and blossom beetle (Tropinota hirta Poda) appear in phenophase green-yellow button-flowering generative organs damage and cause serious damage, resulting in yields significantly reduced.
In recent years, in order to protect the environment, beneficial insects and pollinators limiting the use of chemical means to control enemies. This necessitates the need to seek new alternatives, as a number of substances of plant origin exhibiting an insecticidal effect.
Therefore, under laboratory conditions tested plant extracts: walnut (Juglans regia L.), wild walnut (Ailantthus altissima Swing.), tobacco (Nicotiana tabacum L.), against adult pollen beetle (M. aeneus) and blosson beetle (T. hirta). The results of conduct studies show that high effectiveness against adults poleen beetle (Meligethes aeneus F.) occurs with the use of plant extracts in a solution with a concentration above 1% more on the third day, bat by blossom beetle (Tropinota hirta Poda), an effect of treatment with the extract was observed only 7th day irrespective of the concentration.

Key words*: oilseed rape, pests, biological control, insecticide, plant extracts.*

INTRODUCTION

Limiting the application of chemical means to control pests of crops, in order to protect the environment, maintain biodiversity, preserving regulatory role of beneficial insects and pollinators, and economic aspects of plant protection, make it necessary to seek new alternatives for control pests.
In the literature there are reports of a number of natural plant products that exhibit insecticidal action and can be successfully used in the control of pests. Moreover, they are safe for humans, domestic animals do not have a negative impact on beneficial species and pollinators for crops.
During flowering key pests on oil seed rape are: pollen beetle (*Meligethes aeneus* F.), blossom beetle (*Tropinota (Epicometis) hirta* Poda) and *Oxythyrea funesta* Poda.
According to several authors Hansen (1996), Coll et al., (1998), Mason and Huber (2002), Heimbach et al. (2007), Kazachkova (2007), Ahmanl et al. (2009), Erban et al. (2017) pollen beetle (*M. aeneus*) directly threatens yields in some years could compromise the crop damages adults and larvae (Blight and Smart, 199). They feed on flower buds, and therefore the yield of seed are significantly reduced (Ruther and Thiemann, 1997). The losses in some years reach 30-80%, while in the case of mass-multiplication 100% (Wegorek and Zamoyska, 2008).
According to Farkas and Kondor (2014) blossom beetle (*Tropinota hirta* Poda) also damage reproductive parts of rape and favorable climatic conditions can spread massively in rapeseed sowing. The main cause damage to adults who eat mostly color and mass appearance causing serious damage.
In recent years pollen beetle (*M. aeneus*) and blossom beetle (*T. hirta*), shows resistance applied in practice insektitsidae as a result of which seek alternative plants extracts – protective means of control that are safe for bees, as it is known that the oil seed rape is one of the best honey plants and are often frequented by bees during flowering.
In their studies Bommarco et al. (2012) found that the bees play an important role in the pollination of oil seed rape as a result of which is obtained in a higher yield as compared with the pollination by wind.

According Pavela (2011) on the one hand the insecticide effect of plant extracts is possible to reduce the density of the enemy, the other to cause antifidant action.

A number of authors Pavela (2005, 2006, 2009), Pavela et al. (2009 a,b), Zabka et al. (2009), Nerio et al. (2010) in their research found that essential oils derived from plant species exhibit insecticidal, fungicidal and bacterial action. As in most cases the essential oils exhibit activity against pests (Isman, 2000; Nerio et al., 2010).

Pavela (2011) tested the insecticidal activity of essential oils from 9 plant species: *Carum carvi* L., *Cinnamomum osmophloeum* Kaneh., *Citrus aurantium* L., *Foeniculum vulgare* Mill., *Lavandula angustifolia* L., *Mentha arvensis* L., *Nepeta cataria* L., *Ocimum basilicum* L., *Thymus vulgaris* L. against adults pollen beetle. The results of the monitoring show that the tested essential oils exhibit high efficacy and cause of death of adult insects. Plant extracts of caraway (*Carum sarvi* L.) and thyme (*Thymus vulgaris* L.) exhibit the highest efficiency from 65,6 to 63,8%.

Based on their observations Hummelbrunner and Isman (2001), Pavela (2008) found that essential oils of vegetable origin can cause not only mortality, they also affect fertility and lifespan of their enemies.

In this regard, the present to establish insecticidal activity of some plant extracts against economically important pests poleen beetle (*Meligethes aeneus* F.) and blossom beetle (*Tropinota hirta* Poda).

MATERIALS AND METHODS

Studies have been conducted in the laboratory at the Agricultural University - Plovdiv. V test took plants extracts of the following types: walnut (*Juglans regia* L.), wild walnut (*Ailantthus altissima* Swing.), Tobacco (*Nicotiana tabacum* L.). To this end, overnight soaked 100 mg of plant mass from in 100 ml of water, then were prepared working solutions at concentrations 0, 0,1, 1 and 100%. Experiment was conducted in 3 repetitions and variations.

In plastic containers are placed in 10 adult insects of polen beetle (*M .aeneus*) and blossom beetle (*T. hirta*) and colors of rape inflorescence immersed in the respective working solution.

The readings took place on the 3rd, 5th and 7th day.

RESULTS AND DISCUSSIONS

The results obtained of testing the insecticidal activity of plant extracts from wild walnut (*Ailantthus altissima* Swing.), tobacco (*Nicotiana tabacum* L.), are presented in Table 1 in pollen beetle (*Meligethes aeneus* F.) and Table 2 in bottom beetle (*Tropinota hirta* Poda).

From the data in Table 1 shows that the tested plant extracts definitely affect the viability of pollen beetle (*M. aeneus*). At all concentrations tested after the third day was not found alive adults pollen beetle (*M. aeneus*). This can explain it with the presence of toxic substances specific to those plant species.

Therefore it was conducted comparing the mean values at the various concentrations. The results of the statistical processing are presented in Table 2 and Figure 1. Of these, it is seen that the control concentration of 0% differs significantly from the results for the other concentrations (0.1, 1 and 100%). This gives us reason to believe that the accompanying solution concentration independent exhibits insecticidal activity against adults of pollen beetle (*M. aeneus*). Between the results at various concentrations there is little statistical difference at 0.1% and 100%.

In Figure 1 are shown that at a concentration above 1% the results are almost identical. Therefore for control against adults pollen beetle (*M. aeneus*) plant extracts to be applied concentration 1%.

Table 1. Reporting efficiency plant extracts of days and concentrations

Concentration (%) Day	3rd	5th	7th
0	10	7.33	5
0.1	3.33	0	0
1.0	2.67	0	0
100	1.33	0	0

Table 2. Variable T-test for Dependent Samples Marked differences are significant at p <0.05000

	Mean	Std.Dv.	t	p
cv100	**1.33333**	**0.577350**		
cv1	2.66667	1.154701	-1.5119	0.269703
cv0,1	3.33333	0.577350	-1.9761	0.013506
cv0	10.00000	0,000000	-26.0000	0.001476
cv1	**2.66667**	**1.154701**		
cv0,1	3.33333	0.577350	-0.7559	0.528595
cv0	10.00000	0.000000	-11.0000	0.008163
cv0,1	**3.33333**	**0.577350**		
cv0	10.00000	0.000000	-20.0000	0.002491

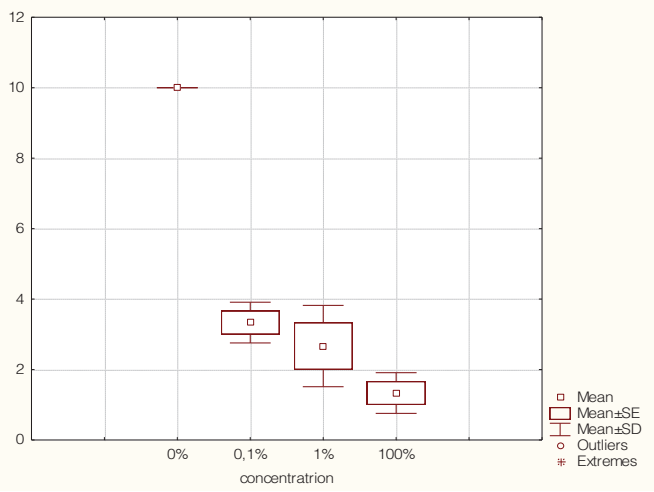

Figure 1. Comparing the averages of the results

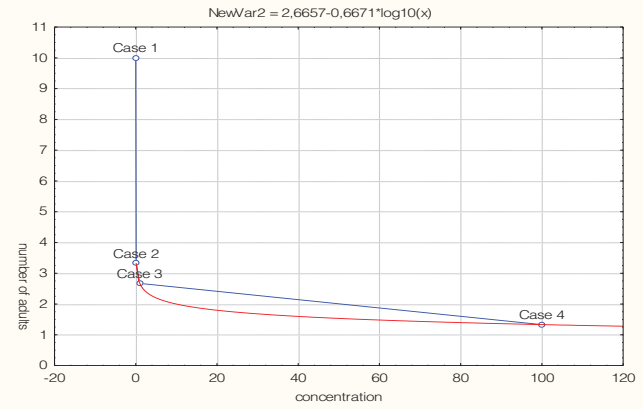

Figure 2. Comparing the averages of the results

Table 3 presents data on the effect of plant extracts against adults bottom beetle (*T. hirta*). There are significant differences in efficacy at various concentrations. There is a defined initiation toxic action, which gradually increases and the seventh day reaches a maximum value, as the efficiency of the test concentrations of 0.1, 1 and 100% on the 7th day was higher compared with that of 3th. This significantly distinguishes it from control.

Table 3. Reporting efficiency plant extracts of days and concentrations

Concentration (%) **Day**	**3rd**	**5th**	**7th**
0	10	8	4.67
0.1	4.33	3	0.33
1.0	4.33	2.33	0.33
100	2.33	1.33	0.33

From the results of Table 3 and the following figures clearly observed trend of reducing the number of living adults of bloom beetle (*T. hirta*) with an increase in concentration and the number of days after treatment. From Figure 3 logarithmic and Figure 4 (in the control, and a concentration of 0.1%) the relationship between the number of days and live adult passes at a linear – Figure 5 and Figure 6 (at concentrations of 1 and 100%)

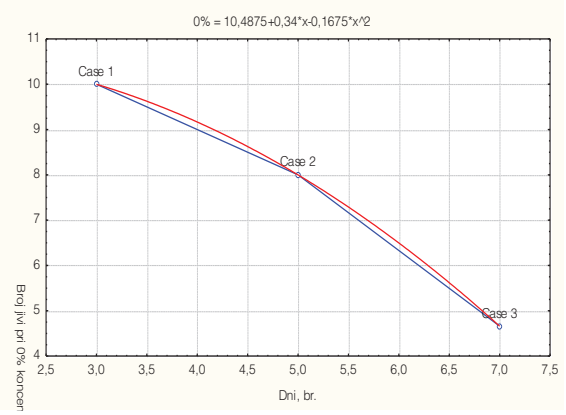

Figure 3. Mortality

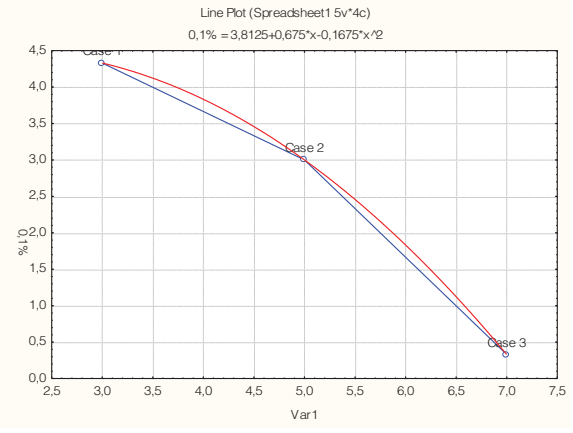

Figure 4. Mortality in concentration 0.1%

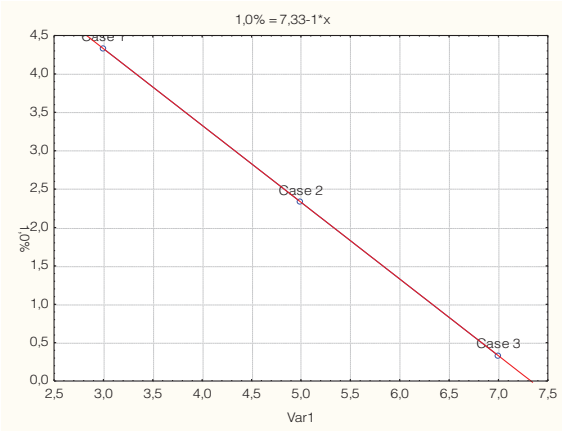

Figure 5. Mortality in concentration 1%

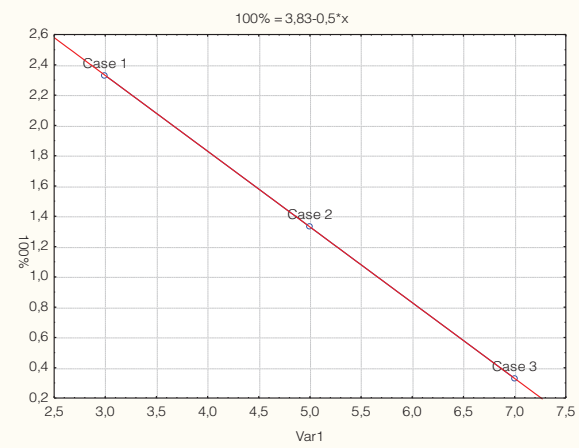

Figure 6. Mortality in concentration 100%

From the figures it can be seen that the number of living adults on the 7th day closer to 0 and at three concentrations of the extract. As an option to speed up the process of destroying them is adding another extract / other plants or repetition of the treatment during the observed period - for example, on the 4th day. However, it is an object of another study.

CONCLUSIONS

As a result of research can draw the following conclusions:

- High efficiency against adults of pollen beetle (*M. aeneus*) occurs upon administration of the pellet in the proposed solution with a concentration of more than 1% even on the third day;
- Due to the greater body weight of bloom beetle (*T. hirta*) and in consequence thereof slower insecticidal action effect of the treatment with the extract was observed only on the 7th day irrespective of the concentration.
- The results are a prerequisite for the application of plant extracts in systems for combating pests of oil seed rape which successfully solves the problem of environmental protection, beneficial insects and bees.

REFERENCES

Ahmanl I., Lehrman A., Ekbom B., 2009. Impact of herbivory and pollination on performance and competitive ability of oilseed rape transformed for pollen beetle resistance. Interactions (2009) 3:105–113.

Blight M.M., Smart L.E.,1999. Influence of visual cues and isothiocyanate lures on capture of the pollen beetle, *Meligethes aeneus* in field traps. Journal of Chemical Ecology, Vol.25:1501-1516.

Bommarco R., Marini L., Vaissiere B., 2012. Insect pollination enhances seed yield, quality, and market value in oilseed rape. Oecologia 169:1025-1032.

Coll C., Booth E.J., Sutherland K.G., 1998. Pest and diseases control requirements for spring oilseed rape in northern climates. Brighton Crop Protection Conference, Pests & Diseases, Volume 3, Proceeding of an International Conference, Brighton, UK, 16-19 November, p.1059-1064.

Erban T., Harant K., Chalupnikova J., Kocourek F., Stara J., 2017. Beyond the survival and death of the deltamethrin-threatened pollen beetle *Meligethes aeneus*: An in-depth proteomic study employing a transcriptome database, Journal of Proteomics, p. 281–289.

Farkas I., Kondor Zs., 2014. The shaggy Rosenkaefer *Epicometis* (*Tropinota*) *hirta* in winter raps - increasing damage. 55. Austrian Plant Protection Days, 26.11. and 27.11.2014, p.45-46.

Hansen L.M., 1996. Blossom beetles in oilseed rape – monitoring and threshold,Danske Plantevernskonference. Sygdomme og skadedyr., p.139-143.

Heimbach U., Muler A., Thieme T., 2007. First Steps to analyse pyrethroid resistance of different oilseed rape pests in Germany. Nachrichtenblatt des Deutschen Pflanzenschutzdienstes, Vol. 58:1-5.

Hummelbrunner L.A., Isman M.B., 2001. Acute, sublethal, antifeedant, and synergistic effects of monoterpenoid essential oil compounds on tobacco cutworm, *Spodoptera litura* (*Lep., Noctuidae*). J.Agric. Food Chem. 49 (2):715–720.

Isman M.B., 2000. Plant essential oils for pest and disease management. Crop Prot.19, 603–608.

Kazachkova N.I., 2007. Genotype analysis and studies of parathyroid resistance of the Oilseed rape (Brassica napus) Insect pest Pollen beetle (*Meligethes aeneus*). Thesis of Swedish university of Agriculture Sciences, p.1-20.

Mason P., Huber J.T., 2002. Biological control programmes in Canada, 1981-2000. CABI Publishing: Wallingford.

Nerio L.S., Olivero-Verbel J., Stashenko E., 2010. Repellent activity of essential oils:a review. Bioresour. Technol. 101, 372–378.

Pavela R., 2005. Insecticidal activity of some essential oils against larvae of Spodoptera littoralis. Fitoterapia 76, p.691–696.

Pavela R., 2006. Insecticidal activity of essential oils against Cabbage aphid (*Brevicoryne brassicae*). JEOBP 9 (2):99–106.

Pavela R., 2008. Acute and synergistic effects of some monoterpenoid essential oil compounds on the house fly (*Musca domestica* L.). JEOBP 11, 451–459.

Pavela R., 2009. Larvicidal property of essential oils against Culex quinquefasciatus Say (*Diptera: Culicidae*). Ind. Crop Prod. 30 (2):311–315.

Pavela R., Sajfrtova M., Sovova H., Karban J., Barnet M., 2009a. The effects of extracts obtained by supercritical fluid extraction and traditional extraction techniques on larvae *Leptinotarsa decemlineata* Say. J. Essent. Oil Res. 21, 367–373.

Pavela R., Vrchotova N., Triska J., 2009b. Mosquitocidal activities of thyme oils (*Thymus vulgaris* L.) against Culex quinquefasciatus (*Diptera:Culicidae*). Parasitol. Res. 105 (5):1365–1370.

Pavela R., 2011. Insecticidal and repellent activity of selected essential oils against of the pollen beetle, *Meligethes aeneus* (Fabricius) adults. Industrial Crops and Products, Vol.34, Issue 1, p. 888–892.

Ruther J., Thiemann K.,1997. Response of the pollen beetle *Meligethes aeneus* to volatiles emitted by intact plants and conspecifics. Entmologia Experimentalis et Applicata, Vol.84, p.183-188.

Węgorek P., Zamoyska J., 2008. Current status of resistance in pollen beetle (*Meligethes aeneus* F.) to selected active substances of insecticides in Poland. Bull. OEPP/EPPO Bull. 38,p.91–94.

Zabka M., Pavela R., Slezakova L., 2009. Antifungal effect of *Pimenta dioica* essential oil against dangerous pathogenic and toxinogenic fungi. Ind. Crop Prod. 30 (2):250–253.