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TESTING THE INSECTICIDAL ACTIVITY OF PLANT EXTRACTS FOR THE CONTROL OF ECONOMICALLY IMPORTANT ENEMIES OF RAPE FROM THE ORDER *Coleoptera*

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Abstract

Rapeseed is attacked by a number of enemies, of which the rapeseed weevil (Meligethes aeneus F.) and the pod borer (Ceutorhynchus assimilis Payk.) are of important economic importance. They damage the generative organs, which is why mining is directly dependent on the organization and effectiveness of the fight against them. In recent years, the mass use of chemical means to combat them leads to the development of resistance, the destruction of useful species and pollinators of cultivated plants. In order to limit their application, alternative means of control are sought to avoid the negative consequences of the use of chemical preparations. In this regard, the efficacy of plant extracts from: walnut (Juglans regia L.), wild walnut (Ailantthus altissima Swing.) and tobacco (Nicotiana tabacum L.) against the adult forms of the rape blossom borer and the pod beetle was tested under laboratory conditions. The attempt was made in four variants and three repetitions. The obtained results show that the compounds contained in the plant extracts exhibit efficacy against the adults of the rape flower borer and the pod borer. The obtained results are a prerequisite for the application of the plant extracts in the integrated systems to combat the enemies of rape.

Key words: *Meligethes aeneus F., Ceutorhynchus assimilis Payk., plant extracts, insecticide activity.*

INTRODUCTION

The canola borer is the most economically important enemy of canola, which can reduce yields by up to 80%. The species appears in rape fields in early spring (BBCH 51-57) and causes the greatest damage in the phenophase of budding-flowering (BBCH 57-60) (Cool et al., 1998; Hovorka et al., 2021). According to Tarang et al. (2004) the main damage is caused by adults. At a density of 1.4-2.5 beetles per plant, seed yield decreases by 3.6 t/ha.

Despite the fact that hidden octopuses appear in calamities relatively less often, they represent a serious danger to the trap. Their losses become obvious when they cannot take any measures to prevent losses (Arabadzhiev, 1959). Overwintering adults migrate to canola in the flowering phenophase (BBCH 61-65), females lay eggs singly in pods (Lerin, 1991) and hatched larvae develop within them (Williams, 2010).

According to Free and Williams (1978), the pod octopus prefers to lay its eggs in pods already damaged by the tropical flower-eater. Fergusan et al. (2003) found that the canola flower eater and the pod octopus meet complexly in the crop and are key enemies of canola (Hovorka et al., 2021).

Essential oils and phytochemicals isolated from plants of the Apiaceae family exhibit good insecticidal activity and inhibitory action against eggs, larvae and adults and can be used in practice to control a number of crop pests (Ebadollahi, 2013).

In his research, Pavela (2011) tested the insecticidal effect of essential oils from 9 plants: *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 the adult forms of rape blossom borer. All essential oils tested showed high efficacy and caused death of adult insects. The highest efficacy, 65.6%, was found in the extracts of caraway (*Carum sarvi* L.) and thyme (*Thymus vulgaris* L.) 63.8%.

A number of authors Pavela (2005, 2006, 2009), Pavela et al. (2009a, 2009b), Zabka et

al. (2009), Nerio et al. (2010) in their research found that essential oils extracted from plant species exhibit insecticidal, bactericidal and fungicidal action.
According to Isman (2000), Nerio et al. (2010) essential oils in most cases are characterized by repellent action against pests.
Hummelbrunnerand Isman (2001) and Pavela (2008) found that essential oils of plant origin could not only cause mortality, but also affect the fecundity and lifespan of predators.

MATERIALS AND METHODS

The studies were carried out under laboratory conditions at the Agricultural University - Plovdiv. The insecticidal action of the following plant extracts: walnut (*Juglans regia* L.), wild walnut (*Ailantthus altissima* Swing.) and tobacco (*Nicotiana tabacum* L.) was tested against the adults of the rape flower borer and the pod borer.
The leaves, stems and flowers of the above plants were soaked for 24 hours in a ratio of 100 mg plant mass: 100 ml water, after which the working solutions were prepared.
The experiment was carried out in three repetitions and four variants: Variant I - wild walnut extract, Variant II - tobacco extract, Variant III - a combination of wild walnut and tobacco, Variant IV - control. In each variant, 10 adult canola borer and pod borer insects, food (canola flowers) were placed in plastic containers and the insects were sprayed with the aqueous emulsions of the plant extracts.
Readings were performed on the 3rd, 5th and 7th day.
The experimental data were compared with the mean values of independent samples at a significance level of $p \leq 0.05$.

RESULTS AND DISCUSSIONS

The results of the conducted research show a clear distinction of the control (Var. 1) from the other variants, which is evident from the variance analysis performed and the applied comparison of the average values.
A statistically proven stronger effect of the extracts on the pod weevil than on the rapeseed weevil was observed, at a significance level of $p = 0.002084$ (Figure 1).

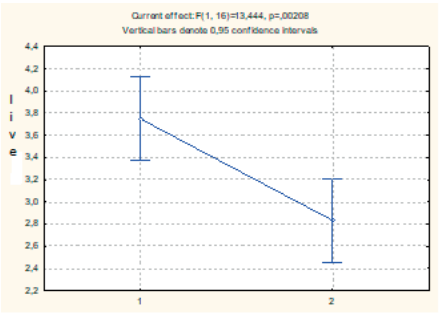

Figure 1. Comparison of impact on enemies - rape flower eater and pod borer

There is a statistical difference in the degree of impact of the individual extracts at a significance level of $p = 0.00005$ (Figure 2).

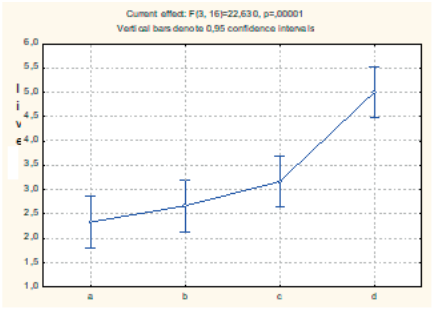

Figure 2. Effect of the extracts: a - tobacco; b - wild walnut; c - tobacco + wild walnut; d - control

With the enemy - extract combination, there is also a proven statistical difference at a significance level of $p = 0.002332$ (Figure 3). This gives reason to claim that, at this stage of the ongoing research, each extract has a different effect on the mortality of different enemies.

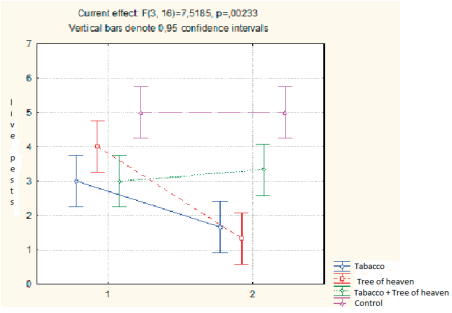

Figure 3. Influence of the combination of the factors on the vitality of the enemies.

There is only a proven statistical difference for the effects of the extracts, at a significance level of p = 0.000001. There is no difference between the individual extracts in their effect on the enemies. The difference is between each one of them and the control (no treatment - Figure 4).

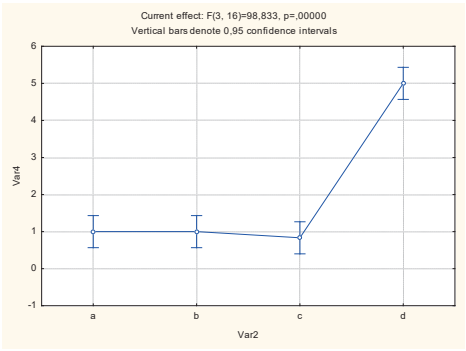

Figure 4. Comparing the effect of extracts and no treatment

On the 5th day the picture is the same as on the 3rd day.

There is a proven statistical difference at a significance level of p = 0.003276 in the effect of the extracts compared to the control (Figure 5) at the 24th hour. At this stage, tobacco extracts and the combination of tobacco and wild walnut have a stronger effect, but without statistical proof.

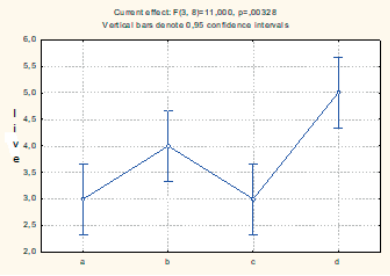

Figure 5. Effect of the extracts: a - tobacco; b - wild walnut; c - tobacco + wild walnut; d - control on the rape flower borer at the 24th hour

There is a proven statistical difference at a significance level of p = 0.000081 in the effect of the extracts compared to the control (Figure 6) on the 3rd day. At this stage, all extracts have the same degree of effect.

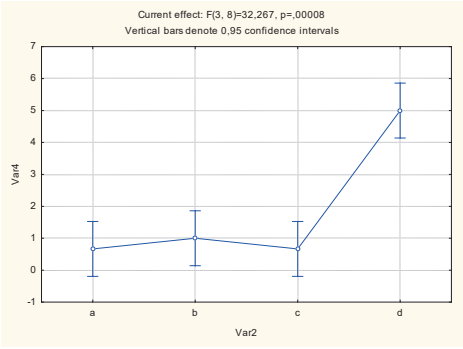

Figure 6. Effect of the extracts: a - tobacco; b - wild walnut; c - tobacco + wild walnut; d - control on the rape flower borer on the 3rd day

CONCLUSIONS

As a result of the conducted studies, the following more important conclusions can be drawn:

1. The compounds contained in the plant extracts of walnut (*Juglans regia* L.), wild walnut (*Ailantthus altissima* Swing.) and tobacco (*Nicotiana tabacum* L.) showed higher efficacy against adults of the pod octopus (*Ceutorhynchus assimilis* Payk.). Among them, the highest tobacco extracts and the combination of wild walnut and tobacco show efficacy.
2. The obtained results are a prerequisite for the application of the plant extracts in the integrated systems for combating the enemies of rape, protecting the beneficial entomofauna and the pollinators of the cultivated plants.

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