International Science Journal of Engineering & Agriculture
2023; 2(1): 49-56
https://isg-journal.com/isjea/
doi: 10.46299/j.isjea.20230201.01
ISSN: 2720-6319

INTERNATIONAL SCIENCE GROUP

Agrobiotechnological method of obtaining plants decoctions to reduce the number of bunch leaf beetle in the Carpathian region

Maria Fedelesh-Gladinets
Department of Genetics, Breeding and Seed Production prof. M.O. Zelensky, National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine
ORCID 0000-0001-7885-6392

Maxim Nahornyi
National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine

Alina Turovnik
National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine

To cite this article:
Fedelesh-Gladinets Maria, Nahornyi Maxim, Turovnik Alina. Agrobiotechnological method of obtaining decoctions of plants in reducing the number of bunch leaf beetle in the Carpathian region. International Science Journal of Engineering & Agriculture. Vol. 2, No. 2, 2023, pp. 39-46. doi: 10.46299/j.isjea.20230201.05.
Received: 11 25 2022 p.; **Accepted:** 12 16 2022; **Published:** 02 01 2023

Abstract. At all stages of crop cultivation, important tasks related to the development of effective measures to protect against the most dangerous pests were successfully solved. The efficiency of insecticide application was theoretically substantiated. A set of scientific researches was carried out to improve environmentally friendly methods of crop protection. The aspects of the use of decoctions of plants and microbiological preparations for the protection of vineyards from the most common pests are presented. It was also established that the decoction of tomatoes and potato tops does not negatively affect the predators and parasites of the bunch leaf beetle. It was studied that the decoction of plants provoked pathogens, especially bacterial, which are in a latent state. When applying a mixture of dendrobacillin 60, caterpillars were pupated from which butterflies did not revive. The results of the death of caterpillars of three generations when using 15 plants, which showed different degrees of effectiveness of decoctions of plants from bunch leafminer in industrial vineyards of the Carpathian region are presented

Key words: agrobiocenoses, vineyards, bunchy leaf miner, infusions and decoctions of plants, plant raw materials, biologically active substances, phytophages, Trichogramma dendrolimi nets, pests, dendrobacillin 60.

1.Introduction

Every year, grape pests destroy most of the crop, suppress grape plants, resulting in a shorter period of plantation operation.

The greatest pesticide load in vineyards is associated with the use of pesticides. Among the pests, significant losses of grape yield are caused by leafhoppers.Viticulture is an important industry for the Ukrainian economy. Cost-effective cultivation of European grape varieties is now possible only with the introduction of grafted crops in the area of distribution not only of the bunch leaf miner and other pests. Every year there is a growing interest in environmentally friendly technologies and scientifically based methods of protecting crops from pests. In industrial culture grapes are grown in the Crimea, southern part of Ukraine in Transcarpathia. The area of vineyards in Transcarpathia in the early 21st century was 6.1 thousand hectares. Of the total planted area, European varieties occupy only 1.9 thousand.

2. Object and subject of the study

The object of the study is grapes, table varieties Arcadia, Vostorg, White raisins, effective measures to protect them from the most dangerous pests. Modern protection of vineyards is aimed at both the destruction of individual harmful species and the overall optimization of individual cells on the culture.

3. The purpose and objectives of the research

The aim of this work was to investigate the effectiveness of agrotechnical, chemical and biological methods of controlling seasonal pests of grapes and to substantiate the measures of integrated protection of plantations. The use of interaction between insecticides, decoctions of plants and phytophages and the development of environmentally friendly means of regulating the number of pests in agrocenoses are being studied.

4. Analysis of literature

M. P. Dyadechko, M. M. Padiy, V. S. Shelestova. M.P. Dyadechko and other well-known scientists of the country devoted a number of studies, developed methods and complexes of measures to protect against a number of harmful invertebrates. Among them is the bunch leaf beetle. Mykola Platonovych Dyadechko became a worthy successor of his senior colleague and teacher M.A. Telenga. Without denying the necessary use of insecticides, he studied alternative methods of plant protection. Unlike many entomologists - producers, Dyadechko highly appreciated the role of entomophages. However, their work did not investigate the use of decoctions of plants as a means of ensuring a sufficiently high level of competitiveness.

5. Research methods

During the writing of the article, field and laboratory research methods were used.

The zone of harm covers the southern regions of Ukraine, damages grapes, in addition, 57 species of different plants from 21 families.

In solving this problem, soil protection and treatment is of great importance.

Agrotechnical methods after the transition of caterpillars to wintering, as well as in autumn and early spring from pests are described in the publications of domestic and foreign researchers.

Chemical methods. Soil cultivation after the transition of caterpillars to wintering, both in autumn and early spring. With a number of more than 2-3 caterpillars per bush - spraying grapes with insecticides at the beginning of the movement of caterpillars to the swollen buds, as well as biological products or insecticides during the mass transition of third instar caterpillars to the tops of shoots (Fig.1.).

Fig. 1. Chemical method of protection against bunchy leaf moth.

The biological method as a system of plant protection, i.e. pest control involves the use of living organisms, with the help of their natural enemies-entomophages, which have been successfully used by mankind for many years. Of course, this method is much inferior to the chemical method, but in the late 19-20 centuries, the biological method became a full-fledged effective tool for protecting crops. Since then, it has been used and developed along with the chemical method. The strong, sometimes poorly controlled chemical industry, over the past decades of environmental poisoning by pesticides, has created a threat of environmental disaster. Pests get used to chemicals, as a result of which it is necessary to create more and more new, more toxic pesticides. However, today, the main and decisive way to ensure a stable and high yield of grapes is the chemical method. The growing scale of production and consumption of pesticides increases the possibility of environmental pollution and the emergence of hazardous to humans and animals, as well as beneficial organisms and microorganisms, long-term consequences of the systematic mass use of plant protection products. Biological method for mitigation of phytotoxic effects of persistent residues depending on soil and climatic conditions, biochemical characteristics of plants and physical and chemical properties of pesticides [2.]

Vineyards in Transcarpathia are damaged by leafhoppers and other pests. Leafhoppers in the vineyards of Transcarpathia are represented by three species: bunch (Lobesia botrana Den. et schiff.), biennial (Eupoecilia amdiguella Nb.), grape (Sparganothis pilleriana Schiff.). Let's consider the bunch leaf moth (Fig.2.)

The bunch leaf moth occurs throughout the territory of industrial viticulture. It is a dangerous pest of grape plantations.

Fig. 2. Butterfly of the bunch leaf moth Lobesia botrana.

Morphological features. Butterfly with wingspan 11-13 mm, forewings olive brown with wide yellowish-white bandage with dark strokes; near inner corner there is a large ochre spot; hind wings are gray, darker towards the edges. Egg size 0.5 - 0.6 mm, slightly elliptical, yellow, flattened. Caterpillar 10 - 12 mm long, olive green, head light brown, pronotum and thorax brown (Fig. 3).

Fig. 3. Caterpillar of bunch leafworm.

Pupa 5 - 6 mm in size, brownish-yellow with greenish gloss and yellow tip of abdomen; on the main segment eight red hook-shaped bristles (Fig. 4).

Fig. 4. Pupa of the bunch leafworm.

Biological features. Pupae hibernate in white silky cocoons in cracks of bark, dense wooden poles, in dry bunches of grapes, fallen leaves and other places. Spring flight of butterflies begins with the onset of stable average daily temperatures of 14 ° C in Transcarpathia, at the end of the second decade of April. In cool spring, the flight of butterflies stretches for 20 - 25 days. Mating occurs in the evening and at dawn, rarely - during the day, in cloudy weather. Butterflies feed on nectar of flowers. On the 5th - 6th day after hatching, they lay eggs singly or in small groups on buds, flowers and inflorescences. Fertility - 60 - 100 eggs. Optimal conditions of the pest are -15 - 30 ° C. The first generation lasts 9 - 10 days, the duration of the second and third - 5 -7 days. After hatching, caterpillars of the first generation feed on buds, damaging flowers as well. One caterpillar damages 40 - 60 buds per hour of its development. Caterpillars develop 23 - 28 days, then pupate. After 10 - 12 days, butterflies of the second generation fly out, laying eggs on green berries. Caterpillars live openly until the first molt, gnawing small depressions on the surface of berries. After that, they penetrate inside and gnaw out cavities in the pulp. After each molting they move to the next berry. They pupate on leaves or berries. Butterflies of the third generation, which fly out in 7-8 days, lay eggs one by one on ripe berries. One caterpillar of the 2nd - 3rd generation damages from 4 to 8 berries [3]. Yield losses are 25 - 30%, and in some years the pest can destroy the entire crop.

One of the promising ways to control pests is biological, the use of drugs from plants. They are based on natural plant biologically active substances, and unlike pesticides, pests do not develop resistance to them.

For practical application, the most important area of ecology is the study of the interaction between plants and phytophages and the development of environmentally safe means of regulating

the number of pests in agrocenoses. Scientists from Ukraine (Derzhypilsky, Babydorych, Mykulin, Vegera) and scientists from Moldova (Koremina) are working intensively in this direction [1.]

6. Research results

On the territory of our country there are few plants that can be considered promising in the fight against pests and diseases. We studied the insecticidal effect of some of them on the bunch leaf beetle in experiments conducted in the laboratory at the University and the Carpathian Biosphere Reserve in 2020-2021, part of the experimental field in 2022. In Transcarpathia, abnormal frosts in the spring and cold and wet early summer of 2020 were one of the worst in a decade. [3.]

The plant raw materials that we harvested during the summer were crushed into pieces of 0.4-2 cm in size or ground into powder and water decoctions were prepared from it, that is, the ratio of dry matter to water is 1:10, fresh - 1:4.

Tested by us 15 plants of the Carpathian region showed different degrees of effectiveness of plants decoctions for caterpillars of bunch leafworm. Thus, the death of the pest caterpillar in laboratory conditions for water decoctions had the following effectiveness in percentages for different plants: ailanthus - 61%, herb elder - 48%, high delphinium - 59%, yarrow - 38%, common tansy - 51%, common dope - 58%, high angelica - 53%, low aconite - 71%, tobacco - 65%, Dalmatian chamomile - 61-64%, celandine - 64-53%, red poppy - 66%, potato tops - 74%, burdock - 68%, Insegar - 67%, decisis - 79%, arrowroot - 76%, demilin - 67%, cymbus - 55%, tomato tops - 75% (Fig. 5).

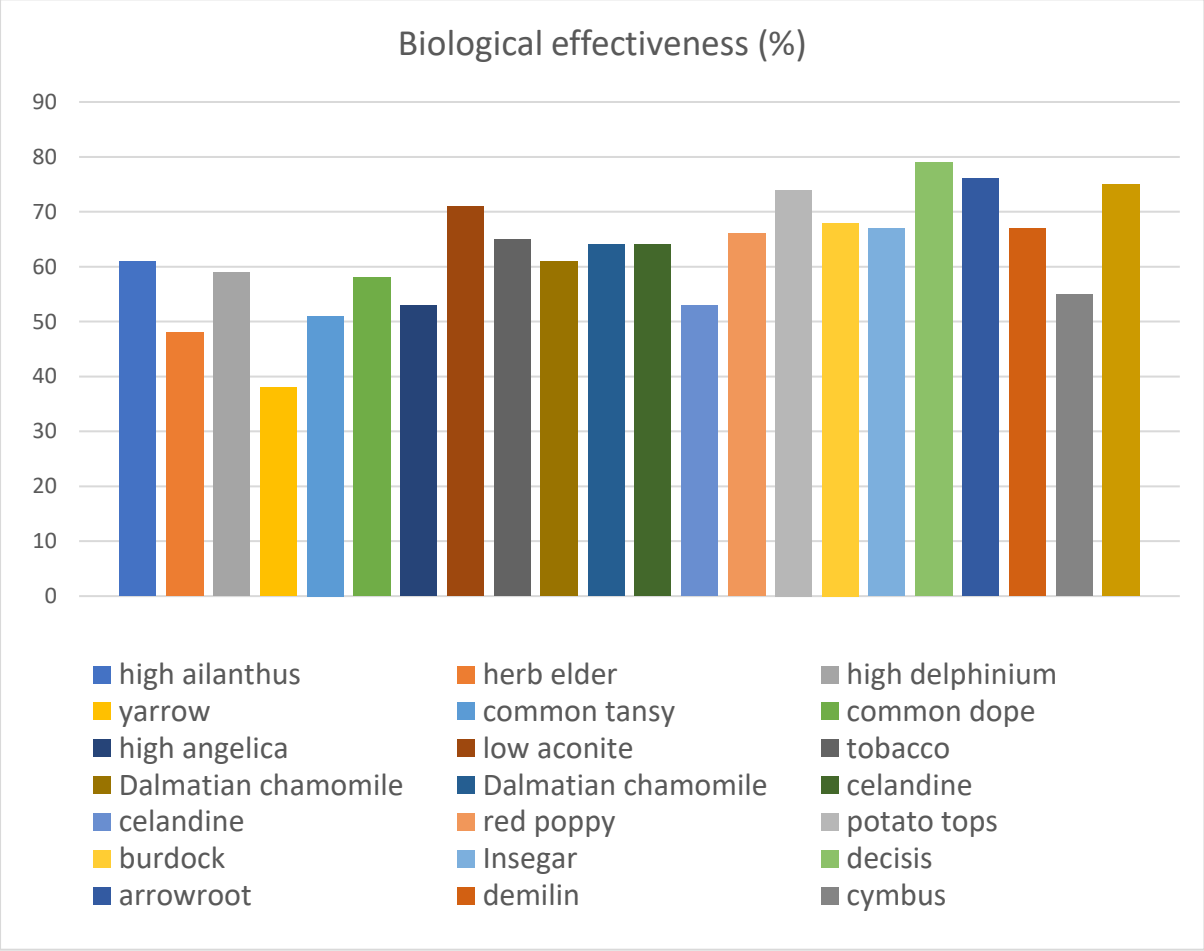

Fig.5. Biological preparations and biological efficacy of decoctions of insegar plants and insecticides in limiting the number of caterpillars of the first generation of bunch leaf beetle.

Field studies with plant preparations were carried out on tomato tops, collected during the period of stepsoning of the crop and dried under a canopy. The crushed dry tops were diluted with water at the rate of 100g in 50l of warm water. Drying the tops in the field significantly reduced the effectiveness of the solution [3].

Preparing the decoction, the plant mass was boiled for 30 minutes. The decoctions were stored in a glass container in a dark cool room. Before spraying, laundry soap was added to the solution as an adhesive at the rate of 20g per 10 liters of solution.

In Berehove viticulture in 2020, more than 1200 vine bushes were treated with tomato tops infusion from a knapsack sprayer with fine spray tips against three generations of bunch leaf moth at the rate of 1 liter of infusion per 10 grape bushes.

The first spraying was carried out on May 25 at the beginning of the mass revival of the first generation caterpillars, the second on July 15 against the second generation caterpillars. Against the third, the most harmful, treatment was carried out on August 17 and 28 during the appearance of the first caterpillars on the bunches.

The death of the first generation caterpillars from the infusion was 54 - 60%, the second 58 - 63%, the third 68 - 75%. Damage to bunches in the experiment did not exceed 2% i.e. it was below the economic threshold of harmfulness. On the control plots the damage was in the range of 22 - 25%.

It was noted that the decoction of tomatoes does not negatively affect the predators and parasites of the bunch leafworm, and the trichogramma dendrolimi TRICHOGRAMMA DENDROLIMI NOTS, which was released during the period of the beginning of egg laying by butterflies, did not die from it (Fig. 6).

Fig.6. TRICHOGRAM DENDROLIMI NETS

Decoction of plants provoked pathogens, especially bacterial, which is in latent state in caterpillars. [1]

7. Prospects for further research development

We have studied a small number of decoctions of plants that can be used in vineyards against bunchy leaf miner. We see prospects for the further development of these methods in the fight not only against pests, but also against many grape diseases.

8. Conclusions

It was found that the use of a mixture with dendrobacillin 60 at the rate of 5 g per 1 liter of

working fluid pupated no more than 0.5 - 1% of caterpillars. Butterflies did not hatch from these pupae.

The same effectiveness of the infusion was noted in 2021.

The cost of harvesting the tops and preparing it for processing the vines was 2.5 times less than when using organophosphorus and peritroide preparations.

With a number of more than 2-3 caterpillars per bush - spraying grapes with insecticides for the organization of measures to protect vineyards, it is necessary to provide for mandatory monitoring of the dynamics of the flight of butterflies of all generations of bunch leafworms, take into account the forecast of the number and harmfulness of the pest and determine the optimal timing of insecticide application, protective treatments will provide reliable crop protection with a reduction in insecticide application up to 60%.

References

1) Andreyuk, K., Iutynska, G., Antipchuk, A. (2001) Functioning of soil microbial coenoses under conditions of anthropogenic load. Science opinion 240 p

2) Babidorych, M., Fedelesh-Gladynets, M. (1997) Against the bunch leaf beetle. Plant protection. Collection of scientific papers 3, 18 p

3) Brovdiy, V., Brovdiy, V., Guliy, V., Fedorenko, V. (2004) Biological protection of plants: teaching. Manual. Svit 352 p

4) Dydechko, M.. (1990) Basics of the biological method of plant protection. Ukraine. 280 p

5) Kalitich, S. (2005) Viticulture. Donetsk: BAO, 128 p

6) Tairov V., Catalog of grape varieties selected. National Center for Selection. – Odesa: Optimum

7) Krutyakova, V., Gulych, O., Pylypenko, L. (2018) Biological method of protection of agricultural crops: prospects for Ukraine. Herald of Agrarian Science 11, 159–168

8) Laskavyi, V., Melkonyan, M., Volynkin, V. (2005) Features of fruitfulness of new varieties of grapes in the conditions of Zaporozhye. Proceedings of the Magarach I&V 35, 34-40

9) Viticulture and winemaking: interdepartmental thematic scientific collection. (2019) dedicated to the 160th anniversary of the birth of V.E. Tairov / NAAS, NSC "Institut viticulture and winemaking named after V. E. Tairov". Odesa: NSC "IViV named after V. E. Tairov" 56, 146 p.

10) Pisarenko, V., Pisarenko, P. (2002) Plant protection: ecologically based systems: a textbook for teaching. and studies agr. special higher education. 2nd ed., revised. and additional – Poltava: Inter Grafika 288 p

11) Krutyakova, V., Gulych, O., Pylypenko, L. (2018) Biological method of protection of agricultural crops: prospects for Ukraine. Bulletin of Agrarian Science 11 (788), 159-168 https://doi.org/10.31073/agrovisnyk201811-20

12) Fedelesh-Gladinets, M., Kanarsky, E. (2013) Obtaining infusions and decoctions of plants by biotechnological methods. Sworld. 1 (38) in the section biology, ecology and biotechnology – P 33.

13) Fedelesh-Gladinets M., Nagorny, M. (2021) Biotechnology of obtaining intenses and decotions of plants from tomato tops to reduce the number of the grape leaf coil in transcarpattia. International Scientific and practical conference "Innovations and prospects of world science" 24 hours of participation (0.8 ECTS credits). Vancouver Canada 1-3 December (90) 22-23. UDC 606:632.7/.95, ISBN 978-1-4879-3794-2

14) Fedelesh-Gladinets, M., Turovnik, A. (2021) Biotechnology of obtaining intenses and decotions of plants from potato pumps for reducing the number of the grape leaf coil in the transcarpattas. International Scientific and practical conference "Innovations and prospects of world

science" 24 hours of participation (0.8 ECTS credits). Vancouver Canada 1-3 December (90) 22-23. UDC 606:632.7/.95, ISBN 978-1-4879-3794-2

15) Shelestova, V., Mohamed Abdul Hakim. (1992) Effectiveness of the use of biological means in the fight against garden leafhoppers. Agrotechnical principles of crop protection from harmful organisms 143-149