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FACULTY OF HORTICULTURE
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SPECIALIZATION: PLANT PROTECTION AND ENTHOMOLOGY

„RESEARCHES CONCERNING THE BIOLOGY, ECOLOGY AND DISPROOF OF COLORADO BEETLE - *LEPTINOTARSA DECEMLINEATA* SAY, BY TREATMENT WITH METABOLITS OF NATIVE PLANTS AND COMERCIAL BIOPESTICIDES”

SUMMARY

Key words: meteorological factors, biological stages, populational control measures

Potato crop plays a main role in the agriculture of Suceava county , occupying approximately 20 to 25% of the county cultivated area. One of the basic conditions for tubers production increases is plant protection in relationship with diseases and pests complex, and among pests, the most important being *Leptinotarsa decemlineata* Say.

The researches goal was to bring new contributions to the study the biology and ecology of Colorado potato beetle and assay of disproof alternatives to the chemical method, using plants metabolical extracts and commercial bioinsecticides.

The first objective concerns the impact of meteorological factors on the occurrence and insect development, how it is affects the life cycle in the climatic change context , in the last two decades. The second objective addressed in this paper, comes to promoting harmfull population control measures to the concept of organic farming, which in addition to the method of disproof used in the conventional system, it was experimented various methods that involve the use of plant extracts and commercial bioinsecticides too.

Research has been conducted over the years 2006 - 2009 in A.R.D.S. of Suceava in frame of Plant Protection laboratory.

The doctoral thesis is structured in two parts, the first part contains the introduction and 3 chapters, and the second, 4 chapters, bibliography and list of publications.

The first chapter of the doctoral thesis “**The actual stage of the researches concerning the morphology, biology and ecology of Colorado beetle (*Leptinotarsa Decemlineata* Say**) “ is an introductory chapter, making synthetic a review of research of morphology, biology and

ecology of the Colorado potato beetle in our country and abroad. It is described, briefly, the insect origin and spread, its occurrence in our country as well as systematic and taxonomic classification of this species. Few references to external morphology were recorded then, it was described the stages of insect development. Each stage of the insect ontology from point of biological needs view, in relation to the duration of its development were analyzed, and the first chapter ends with pedoclimatic factors influence upon Colorado potato beetle evolution and development.

Chapter II, entitled "**Prevention and disproof measures of the Colorado potato beetle**", shows the aspects of damage caused to potato plants and their consequences on the tubers yields. Since the crops set that are grown in Suceava is limited, here it is mentioned, the importance of potato crop and tradition of farming potato in Bukovina. Also in this chapter it is presented, the general measures for the Colorado potato beetle disproof, beginning with agrotehnical measures and continuing with agro-chemical measures and finally, biological control measures are mentioned. The second chapter ends with a presentation of excessive use of pesticides to potato crop consequence, and effects on human health and the environment.

Chapter III refers to "**The knowledge stage at the national and international levels in Colorado beetle disproff domain *(Leptinotarsa decemlineata* Say) with biopesticides and vegetal metabolotis obtained by plants**". This chapter presents the experimental results of an important number of specialists in applied entomology, which have been the subject of numerous papers, useful for plant protection specialists. The first part of this chapter deals with history in pest control using phytochemical compounds then it is described their action by feeding inhibiting, by repellents or capacity to confuse of the insects in addressing of feed source. The following subchapters contain a comprehensive description of the research conducted so far on disproof of Colorado beetle with commercial bioinsecticides and plant metabolic extract.

Chapter IV entitled "**Landscape natural conditions during researches period**" refers to the area description where we have been investigations, specifying the geographical location, climate, soil and vegetation. The experiments were located within Suceava Agricultural Research and Development Station which is located in geomorphological subunit known as Suceava Plateau. In terms of climate A.R.D.S. of Suceava is confined in subhumid area of the country, in the summer with obvious steppe climate influences. As a result of this influence, the frequency of dry year's was up to 20% and the normal (rainfall) year does not exceed 31%. A feature of the four experimented years (2006-2009) compared to the years of the second half of the twentieth century is that although thermal regime has grown, rainfall volume, it was situated, at the cool years level, from the past, when usually between amount of precipitation and the temperature levels there is a contrary interdependence, in that, rainy years were mostly cool.

The experiments have been placed on mollic soils class, soil type being chernozem, evolved from a grassland soil. This soil type occur the largest area of unit land (44%). The natural vegetation of the area is represented by grass species typical for forest steppe climate.

Chapter V entitled "**Purpose and researches objectives. Biologic material and researches methods**" refers to how the experiment was developed, how we manage and interpret results of field and laboratory researches, and methods used to achieve the proposed objectives. The doctoral thesis goal is to bring a significant contribution to scientific data obtained in the course of my own research which are referred to biology, ecology and disproof of Colorado potato beetle.

Pest biology and ecology study concerned a number of aspects of its manifestation in relation to environmental factors, illustration of some interdependencies between stages duration from Colorado beetle onthology and the main characteristics of thermal and precipitation regimes in Suceava. Pest population control comes to promoting disproof measures of the Colorado potato beetle populations in organic farming concept. It was intended to determine the efficacy of plant metabolic extracts and commercial bioinsecticides in the control of Colorado potato beetle in order to practical use in organic potato crops.

The Development cycle of the insect under natural conditions was followed directly in the experimental field, and establishement of vegetable preparations and commercial bioinsecticides efficacy, upon eggs, larvae and adults, and target stages choice for the timing of application was made in both field and laboratory, too.

Chapter VI, "**The researches results concerning the biology, ecology and disproof of the colorado beetles (*Leptinotarsa decemlineata* Say) with support of the metabolits from plants and the comercial bioinsecticides in the Suceava climatic conditions**" is the chapter with the largest share from the total work and includes results presentation and statistical interpretation obtained during the 4 years of experimentation.

Between the meteorological factors was taken into account the influence of temperature and humidity, because they strongly influence the development cycle of the insect. In order to illustrate the interdependencies between stage duration of Colorado beetle ontogeny and the main characteristics of thermal and rainfall regimes have considered the following:

-average air temperatures;

-average daily minimum temperature;

-average daily maximum temperature;

-amounts average daily temperatures;

-amounts effective temperature (temperature daily recorded in the weather shelter reduced by biological threshold value) greater than 5°, 8°, 10°, 12° and 15°C;

-amount of rainfall recorded between stages of insect development;
-nebulozity.

Ontological stages intervals considered include the following phases:
-Stage I (before ponte): hibernate aultsemergence – ponte first deposit;
-Stage II (incubation): ponte first deposit - larvaes appearance on first age;
-Stage III (larvae): larvaes appearance on first age - the first pupes;
-Stage IV (pupes stage): the first pupes - the first generation adult emergence;
-Stage V (before ponte): the first generation adult emergence- ponte first deposit;
-Stage VI (incubation): ponte first deposit – first oviposition ;
-Stage VII (larvae): first oviposition - appearance of the first pupe;
-Stage VIII (pupes stage): appearance of the first pupe - the second generation adult emergence

In this paper is covered some aspects of weather in the winter seazon, how influenced the temperature and precipitation variations the Colorado beetle biological reserve in the soil, the dormancy depth and insect emergence in the spring.

Since between the percentage of adult mortality and average minimum (negative) amount occurring during soil frost period, a significant dependence ($r = 0.95^{x}$) it was resulted, it could admit that without data concerning the development of soil temperatures, can be used the air thermal regime. Amounts of values negative thermal unit ranged from minus 369^{o}C in the winter of 2006-2007 and minus 1173^{o}C in winter of 2005- 2006.

In these circumstances it is estimated that the percentage of hibernate adult mortality was at least apparently dependent on the amount of rainfall recorded during the months November to March, statistical expression of this interrelationship having value of $r = 0.96^{x.}$ Values of the two types of interrelations being very similar, although does not express proportional relationships, however, suggests the impact importance to both climate features on hibernate viability adults.

Most adverse weather conditions, in terms of hibernation, in the winter of 2005-2006 was registered when adult mortality was 70% and the best tolerated conditions were recorded in winters of 2006-2007 and 2007-2008, when the mortality was significantly reduced with 28 and 21%arespectively.

The interdependencies between the soil thermal regime and the depth at which there is the most significant hypothermia tolerance were very clear during investigated period. Thus, in 2006 after a more severe winter, the most numerous hibernating adults were recorded in the soil layer of 31-40 cm, while in other years at a soil depth of 26-30 cm. Below and above these depths hibernating adult population has diminished under the years 2007 to 2009. This process is due to hypothermia in the superficial layers of the soil, and in the deepest (below 30-40 cm), the adults

debilization as a result of increased consumption of carbohydrates and fats during and high crossing thicker of soil layer.

Based on data for 25 years, hibernating adult emergence occurred between April 11 and May 7, the mean date is 25 April, after 55 days from the first March. As a result of global warming, the frequency of hibernating adults in the third decade of April almost doubled compared with eight nine decades of the twentieth century.

Regarding the fight, they used a total of 23 plants that were extracted substances with insecticide potential, by cold maceration. We used these substances singular or in association of two or more extracts. As bioinsecticides have used products Laser 240 SC, NeemAzal T / S and EC Milbeknok both recommended by manufacturer in different doses and proportions.

Regarding Laser 240 SC bioinsecticides, both under field and laboratory conditions at all treated potato varieties, resulted a maximum efficiency mostly on adults, larvae and eggs. At NeemAzal T / S, the overall efficiency is slightly lower, but the number of dead insects is not necessarily a good evaluation criterion. The product works by reducing the function of feeding or growth regulator with a mortality of young larvae after 1-2 days, extending with few days at L3 and L4 larvae and at adults reduced the eggs fertility by increasing the percentage of sterile eggs. Using EC Milbeknok product did not cause dramatic results in the disproof of Colorado beetle, but deserves to be used in eradicating of the other pests.

Although extracts from plants produce mortality of Colorado potato beetle larvae in a lower percentage, though some of them induce inhibition of feeding, because they do not cause damage to leaf area than in a relatively reduced proportion, up to 10-15%. In this regard it is noted the products obtained from *Tanacetum vulgare* L. and the product obtained from combination of *Aconitum vulparia* L. + *Tanacetum vulgare* L. +. *Sambucus ebulus* L. of 10% attack rate and extracts obtained from *Aconitum vulparia* L., extract obtained from combination of *Tanacetum vulgare* L. *Artemisia absinthium* L. and *Athyrium filix-femina* Roth, with 15% attack rate.

Chapter VII entitled "**Conclusions**" summarizes the results obtained during the studied period. Studies undertaken will answer to many questions relating to the biology and ecology of the Colorado beetle in the context of climatic change in the last 20-30 years in Suceava, and the approach of some disproof technologies, unpollutants for humans and environment.

Although about this pest has been written very much, over tim, being the subject of numerous studies, it will be continues to surprise us, even the 60 years since its emergence in Romania