THE INFLUENCE OF METEOROLOGICAL CONDITIONS FROM THE WINTER SEASON ON BIOLOGICAL RESERVE OF *LEPTINOTARSA DECEMLINEATA* SAY. ADULTS, IN THE CENTER OF SUCEAVA PLATEAU

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Abstract

Interdependence between the thermal regime of the soil and the depth at which there is the most significant hypothermia tolerance was put into evidence under 2006-2009. In 2006, after a more severe winter, the most numerous hibernating adults were recorded in the layer of 31-40 cm, while in other years at a depth of 26-30 cm. Below and above these depths hibernating adult population has diminished under the years 2007 to 2009. This is due to hypothermia in the superficial layers of the soil, and in the deepest (below 30-40 cm), adults debilitation, as a result of increased consumption of carbohydrates and fats during break time and high crossing thicker soil layer.

Key words: heat treatment, mortality, adults hibernate, tolerance, hypothermia density

Transition to hibernation stage is preceded by a period of active nutrition, during which the insect body accumulates considerable reserves of carbohydrates and fats which serve as an energy source during break period and in the spring during recovery periods too.

The snow layer provides a favorable shelter for hibernation of most Colorado beetles adults, and during winter's periods without snow and strong frosts, many of them perish because of frost.

At low temperatures, below the lower threshold, the insects become progressively property and numb. Adults death at low temperatures is due, first of free water freezing from intercellular spaces (it formed ice crystals) and then when the temperature goes above a certain limit, the total water from the insect body have been freezing. Before reaching this limit, the insects proceed in anabiosis stage, of which insects can gradually return with the gradually rise of

BIOLOGIC MATERIAL AND RESEARCH METHOD

Under natural conditions for determining the hibernation depth and adult density, 15 surveys were performed at 0-90 cm soil depth, the insects were collected out of 5 in 5 cm on depth. We made the following studies:

- The determination of the hibernation depth;
- The mortality of the Colorado beetle during hibernation period;
- Density of hibernate adults in the natural conditions;

The determination of the mortality during hibernation period and biological reserve of the adults were made using cages with 30 adults who were buried in the soil in autumn while the adults withdrew.

RESULTS AND DISSCUSIONS

In all winters of 2005-2006, 2006-2007, 2007-2008 and 2008-2009 there was only one cold period. If in the last two winters, the cold period was in the first decade of January, but in the winter of 2005-2006 the coldest period was in the third decade of January, and in the winter of 2006-2007 the lowest temperatures, both in air and in soil were recorded in the third decade of February.

The coldest hibernation season was in 2006, when it showed the strongest frequency of decades with lower minimums average – 5^0C and 10^0C both in air and at ground. If we compare with years 2005 - 2006, the cold season from years 2006 - 2007 can be considered the least cold, with one decade with average minimums below - 5^0C. Winter seasons 2007 - 2008 and 2008 -2009 fall between the two

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extremes, respectively 2005 - 2006 and 2006 - 2007.

About the likely effects of thermal regime on adults hibernation proving that in all winters the soil was clearly protected by low temperatures, through presence of a thick snow layer 8-12 cm in temporal sequences with the lowest temperatures

Some considerations concerning the biological reserve of the beetle adults in the soil

Since between the percentage of adult mortality and average minimum amounts (negative) occurring during frost of the soil, resulted a significant dependence (r = 0.95 ^{x}) which it could be admit that without data on the evolution of soil temperatures can be used the thermal regime of the soil surface. Amounts of negative thermal unit values ranged from - 369°C during the winter season of 2006-2007 and -173°C during winter season of 2005-2006.

In these circumstances it is estimated that the mortality rate of hibernation adults (each 30 individuals in every cage) was at least apparently dependent on the amount of rainfall recorded during the months from November to March, the statistical expression of this interrelationship having the value of r = 0.96^{x} . Values of the two types of interrelations being very similar, although not express proportional relationships, however, suggests the importance of impact both climatic features on the viability hibernation adults.

The information included in the table 1 reveals that the worst weather conditions, concerning the hibernation, was recorded in winter season of 2005-2006 when adult mortality was 70% and the best tolerated conditions were recorded in winter season of 2006-2007 and 2007-2008, when mortality was significantly reduced with 28 and 21%.

The 15 surveys conducted at depths listed in table 2 suggest that the adult's number hibernated variation was due equally like intensity to both factors - year and depth. But in terms of frequency the depth of hibernated adults where they were positioned influenced in more "circumstances" the population density.

Table 1

The mortality rate during hibernation period

Years	2006	2007	2008	2009
% mortality	70	42	49	59
Differences	St.	-28^{ooo}	-21^{oo}	-11
Dl 5% - 11%	Dl 1% - 16%		Dl 0,1% - 22%	

Table 2

The variation of the hibernated adult's number at different depth during years 2006-2009

The depth (cm/mp)	Years				Differences because of years		
	2006	2007	2008	2009	2007	2008	2009
0 -10	0,07	0,20	0,13	0,13	0,13	0,06	0,06
11 - 15	0,27	0,27	0,07	0,27	0,00	-0,20 ^{o}	0,00
16 - 20	0,07	0,13	0,20	0,27	0,06	0,13	0,20 ^{x}
21 - 25	0,20	0,40	0,20	0,47	0,20 ^{x}	0,00	0,27 ^{xx}
26 - 30	0,53	0,80	0,47	0,72	0,27 ^{xx}	-0,06	0,19
31 – 40	0,93	0,40	0,33	0,33	-0,53 ^{ooo}	-0,60 ^{ooo}	-0,60 ^{ooo}
40 - 50	0,26	0,26	0,07	0,20	0,00	-0,19	-0,06
Differences because of depths							
11 - 15	0,20 ^{x}	0,07	-0,06	0,14	Dl 5% - 0,19 Dl 1% - 0,26 Dl 0,1% - 0,36		
16 - 20	0,00	-0,07	0,07	0,14			
21 - 25	0,13	0,20 ^{x}	0,07	0,34 ^{xx}			
26 - 30	0,46 ^{xxx}	0,60 ^{xxx}	0,34 ^{xx}	0,59 ^{xxx}			
31 – 40	0,86 ^{xxx}	0,20 ^{x}	0,20 ^{x}	0,20 ^{x}			
40 - 50	0,19	0,06	-0,06	0,07			

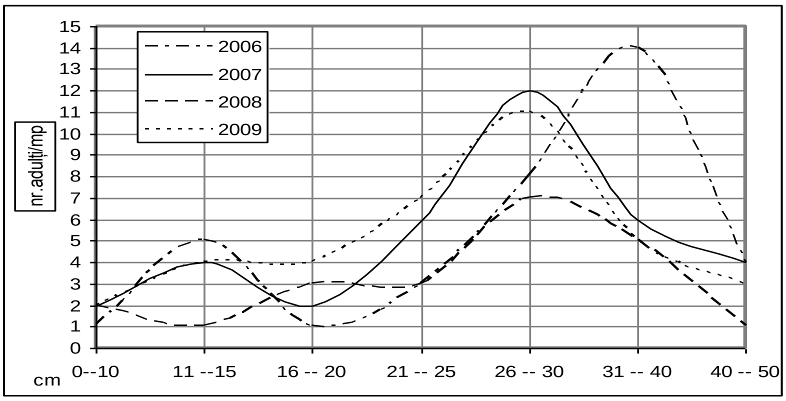

Figure 1 **Graphic expression of the adult hibernation depth**

Interdependency between the soil thermal regime and the depth at which there is the most significant hypothermia tolerance is illustrated by the data given in table 2. Thus, in 2006 after a more severe winter, the most numerous hibernating adults were recorded in the layer of 31-40 cm, while in other years the hibernating adults were recorded at the depth of 26-30 cm (Fig. 1)

Below and above these depths, hibernating adult population has diminished under winter conditions of the years 2007 and 2009. This is due to hypothermia phenomenon in the superficial layers of the soil, and in the deepest (below 30-40 cm), because of adults debilitation as a result of consumption increased of carbohydrates and fats during break and high crossing thicker soil layer.

In Suceava County, the smallholders practice the potato monoculture, because of lack of areas. In a study made by the ARDS Suceava, in some experimental areas for determining of the load average adult /m^2 at a potato monoculture of 2, 3 and 4 years (Fig. 2). Besides of agrophytotechnic, phitotopathologic and economic effects, if we refer only to the Colorado beetle resulted that after performing the 15 polls in 0-90 cm soil depth, the average load adults is 0.8 m adults in two years potato monoculture , increasing to 1.2 adults in the three-years monoculture and 1.6 adults /m^2 in four-years monoculture. In a simple calculation we will have approximately 16,000 adults/ha (after Daniela Donescu et al. 2006), and a production losses of 40% , and 20,000 adults / ha will causes a production losses of 50%.

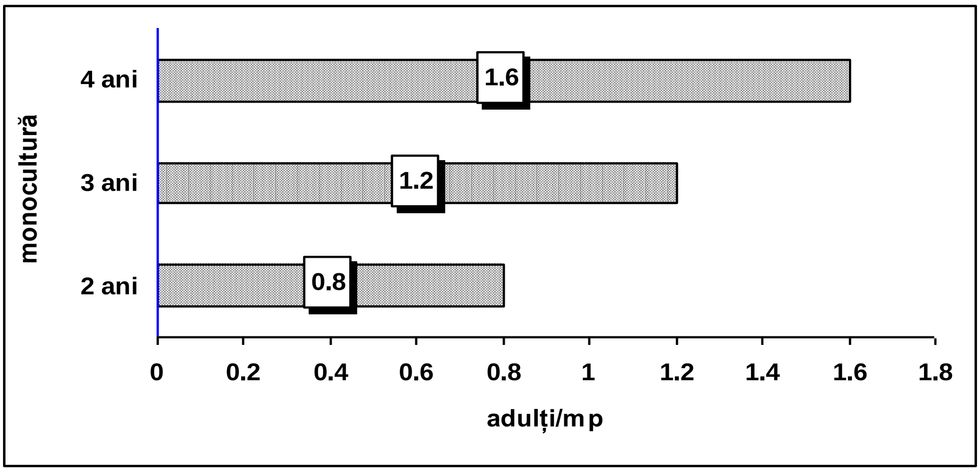

Figure 2 **Hibernate adults density in potato monoculture**

Since missing data on soil thermal regime in Table 3 are listed values of air temperature, by which we can emphasize some aspects related to their influence on the emergence of hibernating adults

Based on data for 25 years, hibernating adult emergence occurred between April 9 and May 5, the mean date is 25 April, that mean, after 55 days from date 01.03. As a result of global warming, the frequency of hibernating adults in the third decade of April almost doubled compared with decades eight and nine of the twentieth century.

Great date of occurrence adults hibernate amplitude is shown both the variable coefficient (s%) which is very high (33-42%, Table 4) and very low value (-0.07 to 0.12, table 5) of the correlation coefficients between dates of adult hibernate emergence and days with average temperatures greater than 5° or 8°C reported to the first of March.

Between appearance "moments" of 2 - 3 days with 5° and 8°C there was not significant temporal relationship, the correlation index being very low (0.405). Largely, it contributed the fact that in the interval between the average temperatures appearance of 5° or 8°C and emergence hibernate adults temporal sequences with temperatures below two mentioned levels occurred. Thus 23% of the 34 days had average temperatures below 5°C and 48% of the 29 days were below 8°C. The correlation coefficients (0.658 ^{xx} and 0.655 ^{xx}) suggests that the mentioned frequencies were significantly prolonged cold days during the interval between occurrences of reference temperatures and hibernating adult emergence.

Table 4

Duration dependence to hibernate adult emergence of both air thermal limits

Specification		Correlation coefficients (r)
Mean temperatures ≥ 5^{o}C	active	-0,076
	effective	0,120
∑ mean temperatures ≥ 5^{o}C	active	0,791 ^{xxx}
	effective	0,648 ^{xx}
Mean temperatures ≥ 8^{o}C	active	0,343
	effective	0,389
∑ Mean temperatures ≥ 8^o	active	0,699 ^{xx}
	effective	0,687 ^{xx}

CONCLUZIONS

1. Hibernate-adult mortality (Ah) is dependent on both the amount of negative temperatures (r = 0.95 x) occurred during soil freezing and the amount of rainfall recorded during the months November to March (r = 0.96 ^{x});
2. The slight decrease of the adults biological reserve were recorded in the 30-40 cm layer in more severe winter (2005-2006), and at a depth of 25-30 cm in moderate winters (2006-2007 and 2007-2008). Numerical decrease of hibernate adults above mentioned depth is due to a more pronounced hypothermia induction, and that found in these depths can be attributed to adult awareness as a result of increased carbohydrates and fats consumption during break time.
3. Compared with charge of 0.8 hibernate adults/m^2 in two years potato monoculture their number has doubled (1.6/m^2) in four years potato monoculture.
4. Based on information accumulated during 25 years (1976-1995 and 2005-2009) average time hibernating adult emergence is 25 April. If the average error is taken into account - nine days - that probably hibernating adult emergence occurred between April 16 and May 4. Amplitude of its occurrence has been much broader i.e. 11.04-19.05

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